HAND-BOOK

OF THE

ECONOMIC PRODUCTS

OF THE

PUNJAB,

WITH A COMBINED INDEX AND GLOSSARY OF TECHNICAL VERNACULAR WORDS.

VOL. I.

ECONOMIC RAW PRODUCE.

PREPARED UNDER THE ORDERS OF GOVERNMENT,

BY

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NOTICE.

r is necessary that a word or two should be said in explanation of the .ystem of spelling adopted in this book.

From typographical and other difficulties, the varieties of consonants ın the vernacular, have not been distinguished by the diacritical points sometimes adopted. To this, indeed, an exception is to be found in the ıasal "n" which often closes Punjabí words, this is represented by "ṅ."

The vowels in all purely vernacular words are either accented or unaccented. Of the accented vowels—

á is always broad, as in the French "gâteau."

e is always pronounced "ay," or as "é" in French.

í is long, as "ee."

o is long, like "ó" in depôt.

ú is long, as "oo."

y is a consonant, as in "yes."

The unaccented vowels are—

a always like the "a" in "organ."

i like "i" in "pit."

u like the "u" in "full."

The varieties of consonants need not, for the mere understanding of he terms in this book, be nicely attended to.

Indeed, in any case, it is rare to find an European who really dis- nguishes between the س and the ص ; or between ض, ظ, ذ, ز.

The only thing I could have wished would have been to distinguish he guttural غ gh̲ain, and the kh̲e خ ; but this was impracticable for want of type.

I may add in the āin ع is represented by an apostrophe (') before the vowel to which it is attached.

Any reader who will remember the vowel list, just given, will find no iculty in correctly pronouncing the vernacular words in the book.

I have not, however, thought it necessary to alter the received spelling of such common words as "Calcutta," "Punjab," "Lahore;" but in the case of the technical names of trees, &c., every one's experience of the defects of such an uncertain method as that adopted in Piddington's and other lists, will tell him that there is no other system which secures accuracy but the "letter for letter" system.

CONTENTS.

CLASS III. PRODUCTS OF THE VEGETABLE KINGDOM.

CLASS IV. SUBSTANCES USED IN MANUFACTURES.

ERRATA ET ADDENDA.

Page 1-3 and *passim*, *for* "Bishahr," *read* "Basahir."
„ 3, Col. 2, *for* "Vana," *read* "Rana."
„ 6, No. 18, *for* "chinobar," *read* "chinchar."
„ 8, „ 33, *for* "Jhilam district," *read* "Jhang district."
„ 14, *for* "Kábal," *read* "Kábul."
„ 41, Col. 1, *for* "pullahi," *read* "phulahi."
„ 42, No. 262, &c. *for* "Jeráhat," *read* "Jaráhat."
„ 49, Col. 2, *for* "Khatán," *read* "Khutan."
„ 63, No. 339, "lamp black" has been erroneously placed with the *mineral* colors.
„ 66, „ 352, *for* "Káshkár," *read* "Káshgár."
„ 96, „ 417, *for* "vitrous," *read* "vitreous."
„ 102, „ 521, &c., *for* "tanki," *read* "tabki."
„ 104, „ 531, *for* "dar," *read* "dár."
„ 112 (heading "alum"), *for* "FHITKARI," *read* "FITKARI."
„ 123 (bottom of 2nd col.), *for* "20,000 feet," *read* "26,000 feet."
„ 153, No. 161, *for* "samundar khág," *read* "samundar chág."
„ 156 (2nd col. last line), *for* "kimakht," *read* "kimukht."
„ 158, No. 651, *for* "Shíraz," *read* "Shírnas."
„ 177 (1st col. *note*), *for* "collapes," *read* "collapses."
„ 187, last line, *for* "of," *read* "off."
„ 193, No. 757, *for* "dying," *read* "dyeing."
„ 197 (1st col.), *for* "dámani-i-koh," *read* "dáman-i-koh."
„ 204 (1st col.), *for* "*Aconitifolious*," *read* "*aconitifolius*."
„ 239, No. 841, *after* "phog," *insert* "the flower and fruit of "*Calligonum polygonoides*."
„ 244, „ 870, *for* "suya," *read* "siya."
„ 244 (2nd col., bottom), *for* "atháwaná," *read* "atharvaná."
„ 245, No. 880, *for* "*Cenchrus echiatus*," *read* "*C. echinatus*."
„ 257, „ 893, *for* "samárák," *read* "samáruk."
„ 260 (top of 2nd col.), "used by miris," *read* "Kashmíris," and *dele* the syllable "kash" in the 2nd line above.
——— "calliflower," *read* "cauliflower."
„ 264, No. 923, *after* "phogli," *insert* "(*Calligonum polygonoides*.)"
„ 269 (bottom of 2nd col.), *for* "berberi," *read* "berberis."
„ 270, No. 962, *for* "dágh," *read* "dákh."
„ 319 (1st col.), *for* "phalijari," *read* "pitjari."
——— (2nd col., top), *for* "raisin," *read* "currant;" *for* "resembles," *read* "is;" and *for* "*Berberis lycium*," *read* "*Berberis sp.*——."
——— *for* "*Foliosum*," *read* "*foliolosum*."
„ 320 (1st col., near bottom), *for* "a species of *prunella*," *read* "*Prunella vulgaris*."
„ 322 (3rd and 4th headings), *read* "MOIST," *for* "*dry*;" and "DRY," *for* "*moist*."
„ 323, No. 1079, *after* "dried," *add* "they are imported from Afghánistán."

ERRATA.

Page 323, No. 1084, *for* "*foliosum*," *read* "*foliolosum*;" and *for* "phalli jari" *read* "pílí jari."
„ 326, „ 1094, *after* "champa," *add* "chirmatti."
——— Note (last word), *for* "Delhi," read "Lahore, Múltán and the Sutlej at least."
„ 330, No. 1122, *for* "*Polynisia*," *read* "*Polanisia*."
„ 335, „ 1163, *after* "damáhán," *add* "damiya, dhamiya or tamiya (Pjí)."
„ 336, (heading), *for* "*Aquilariaceæ*," *read* "*Aquifoliaceæ*."
——— No. 1173, *for* "flood," *read* "blood."
„ 337, „ 1175, *for* "*Quassides*," *read* "*Quassiades*."
„ 339, „ 1196, *for* "*Clitoria ternata*," *read* "*Clitoria ternatea*."
„ 343, „ 1224, *for* "*medicinale*," *read* "*medicaginia*."
——— „ 1232, *for* "alsus," *read* "absus."
„ 346, „ 1247, *for* "*rubicunda*," *read* "*rubicaulis*."
„ 348, „ 1269, *for* "*Citrullus colocynthus*," *read* "*Cucumis colocynthidis*."
„ 351, „ 1295, *after* "(2435), Kashmír," *add* "wild."
„ 352, „ 1299, *for* "parsley," *read* "*petroselinum*."
——— (column 2nd, near the bottom), *for* "his," *read* "the."
„ 353, No. 1300, *after* "*Sium sp.*——?" *add* "or *Eryngium*."
——— „ 1300, *for* "species of *Convallaria*," *read* "*Convallaria verticillata*."
„ 357, „ 1326, *for* "*Spilanthus*," *read* "*Spilanthes*."
„ 358, „ 1334, *after* "gokru," *dele* (?).
„ 359, „ 1343, *after* "*Ferruginea*," *read* "(or *Europea*)."
„ 361, „ 1358, *for* "Rhazia," *read* "Rhazya."
„ 367, „ 1421, *for* "Pharbites," *read* "Pharbitis."
„ 373, „ 1460, *after* "Kaukol mirich," *add* "this name is also given to the berries of *Celtis*."
„ 374, „ 1467, *after* "*Tiglium*," *add* "*Baliospermum indicum*."
„ 376, „ 1474, *for* "*Rottleria*," *read* "*Rottlera*."
„ 394 (3rd col.), *for* "*Foliosum*," *read* "*foliolosum*."
„ 395 (2nd „), *for* "generally," *read* "generically."
„ 403 (2nd „ near bottom), *for* "alternative," *read* "alterative."
„ 404 (2nd „ 3rd line from bottom), *for* "yields," *read* "yield."
„ 471, No. 1718, *for* "cusps," *read* "cups."
——— „ 1723, *for* "jhánd," *read* "jhand."
„ 472 (top of 2nd column), *for* "bhán," *read* "bán."
„ 503, No. 1751, *dele* † from the word "Kangra," and place it against "ROYLE," further down.
„ 510, „ 1759, *for* "tirwah," *read* "Tiroch."
„ 514, „ 1785, *for* "ser" *read* "sar."
„ 524, *for* "GOLDSTREAM," *read* "COLDSTREAM."
„ 541 (near bottom), *for* "*seorrata*" *read* "*serrata*."
„ 564, No. 1809, *for* "chota búti," *read* "chitta búti."
„ 564, „ 1810, *for* "lathes," *read* "laths."
„ 591, „ 2018, *add* "(or *P. arya?*)"

INTRODUCTION.

WHEN the Exhibition of 1864 closed, it was designed to publish a Catalogue of the articles exhibited, together with a brief description, such as was published after the International Exhibition of 1862.

But gradually as the work progressed, it was found that the materials available could be worked up into something more complete than a mere Catalogue; and, consequently, the original design was abandoned, and I set myself to the task of endeavouring to prepare a "HAND-BOOK OF THE ECONOMIC PRODUCTS OF THE PUNJAB."

For writing such a Hand-book, it would have been necessary either to adopt an alphabetical arrangement of the names of articles described, or else to classify the specimens and describe the products according to classes. This latter plan was adopted, partly because it was easier in the state in which the materials then were; partly because the principle of classification is more scientifically correct, and helps to give a better idea of the groups of products which the province supplies; and partly also, because adopting a classified plan, and taking the individual specimens for description from the Exhibition collection, the original design of preparing a Catalogue would not be altogether overthrown.

Moreover, in preparing the collection of the Central Museum at Lahore, in the Economic Department, the specimens have been so selected and arranged, as to illustrate this Hand-book; and now any visitor going round with the volume in his hand will be able to examine in substance, any specimen he reads a verbal description of.

A collection properly grouped together becomes to the intelligent spectator, a perfect history of the social condition of the country it represents. The peculiarities of various tribes are revealed by their clothing, by their arms, and their trade implements, which are represented in appropriate sections of the collection,—while the prevalence of peculiar classes of manufactures, the specimens of their fine arts, and their musical instru-

ments, give an insight into the tastes and habits of the people, and indicate to a certain extent, the phenomena of their mental and moral condition. Nor is this all; the grouping together of series of products of different localities, especially in a provincial Exhibition, gives us more information about the trade resources of the country and shows more what it is capable of producing, than the most detailed accounts of travellers and observers, be they never so acute; for, provided only that the district collections be made with ordinary intelligence, we have the inestimable advantage of taking a comparative view of several regions rather than an isolated view, however perfect, of any one. Nor does our knowledge of language pass without benefit; the interesting synonyms that occur as we review the same substances produced by different districts and note the names that each district gives them, furnish us with a fund of information that dictionaries and text books can never supply.

The Exhibition of the Punjab of 1864, was the first of the kind in Upper India, and was opened almost simultaneously with the Agricultural Exhibition of Calcutta, and was closely followed by an Exhibition held at Roorkee, in the N. W. Provinces.

The Exhibition was primarily for the products of the Punjab, including Kashmír and adjacent States, and the hill districts of Simla and Kangra, as far as Spiti, Lahaul, and the borders of Thibet. The political boundaries of the Punjab were taken for the purposes of the Exhibition rather than the natural or geographical, and accordingly the gold tinsel work and ivory miniatures of Delhi and the indigos of Hansi, were allowed to compete as Punjab produce. Accordingly the present work includes the products of all these territories.

It will be observed, that apart from those articles which are confessedly foreign, or derived from other parts of India, there are a large number, and especially in the raw produce department, which, though found in every bazar, or commonly used in particular districts, are not the actual produce of the places from which they are exhibited, but are in fact collected from a variety of external sources. In not a few districts, the imported articles are quite equal in number to the indigenous. If a district is specially productive of any particular commodity, it is sure to be deficient in some other, which it has to import. If, for instance, the district produce all the grain it consumes, it is likely to import the greater part of its other requisites,—if it is a dye-producing district, or a mineral

yielding one, like the Hill States, its grain will be imported. It may be interesting therefore briefly to review the principal sources whence the various articles, raw and manufactured, which are in use in the Punjab, are derived. The various commodities may be conveniently grouped as follows:—

I.—Articles produced either in the place where they are found or in some other adjacent district within the Punjab—these may be subdivided into two marked classes, as the produce of the Plains, and of the Hills. II.—Goods derived from Kábul, Kandahár, Bukhára, and Bádákshán, &c.; through the Bolan, Khaibar, and other passes and routes of the West and North West Frontier. III.—Articles direct from Kashmír and its provinces, and with them may be classed the Thibetan products, coming *viá* Yarkand. IV.—Articles brought from Hindústán, by Delhi &c. V.—Articles imported from Bombay, Káráchí, and from Calcutta. The substances included in this last division are in their turn the products of a variety of countries, European, Asiatic, and African; it will be sufficient however, for our purpose, to trace them to their great marts, with which alone the merchants who bring these products northward have any connection; merely distinguishing European goods from those of Africa, Asia, and the Persian Gulf. A few articles from the Straits Settlements have to be included in this division, still fewer from China, and some from Ceylon, such as gems, pearls, and spices. This completes the list. I now proceed to notice the various classes of articles in the order in which they are enumerated.

I.—Articles produced within the Punjab, comprising the produce (1st) of the Plains; and (2nd) of the Hills.

The Plain districts of the Punjab, greatly resemble one another in their general physical features,—the main difference consists in the fact that some are better irrigated than others, and that some include large tracts of sandy unproductive country, like the desert portion or "thal" of Múltán or Muzaffargarh. The climate of such districts is hot and sultry; the amount of rain that falls is at its minimum and cultivation is almost entirely dependent on canals and artificial irrigation. In this respect no doubt these districts differ widely from the rich plains of the Jálandhar and Bári Doabs, where not only do the great rivers fertilize the soil, but the periodical rainy season seldom fails to yield an abundant increase to the summer sown crops of the "kharíf."

Exclusively consisting of an alluvial clay soil, more or less intermixed with sand, which has been either washed down by the great rivers or collected together by the effect of wind-storms, the plains contain but few mineral products.* In almost all districts "kankar," consisting of irregular and fantastically shaped pieces of calcareous concrete, abounds; this forms the principal material for road-making, and this is the substance, of which is constructed, for more than two-thirds of its whole length, that gigantic roadway, which connects the capital of our Indian Empire with its farthest outpost on the Khaibar frontier: this mineral also yields when burnt, an excellent lime for mortar, a quality not a little valuable in districts where for miles round, the plough of the farmer never strikes upon a stone, and which would be otherwise dependent upon the imports of other districts before a single house could be erected.

Coarse pottery clay is found in every district, sufficiently plastic to produce the rude vessels in common use, and generally fit for brick-making; while the relics of these manufactures again furnish a material for road-making, or ground into powder form the "surkhi" used to mix with lime for building purposes. Some white clays occur in several parts, which are only useful as washes for houses and walls. Common salt is produced by evaporation from brine pits in the Gurgaon district, and together with the produce of the "Sámbhar" and other salt lakes of the Jaipúr territory, forms an important article of export eastward; while all the Punjab proper, down to the southern Deraját is supplied from the mines of the Salt Range, where vast beds of pure rock salt are either worked in open quarries or by galleries and shafts cut in the salt rock itself. Saltpetre is made in most of the plain districts, particularly in Múltán, Dera Ghází Khán, Jhang, and Gugaira, where it effloresces spontaneously about old ruins, and is collected and purified by boiling and re-crystallization. It forms a considerable article of export both inland, beyond the frontier, and also to the seaports. A company for the manufacture of saltpetre has recently been established at Múltán. Crude soda, called "sajji," is produced in Sirsa and Gugaira, &c., by burning various saline

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* Speaking of the "plains" in this place, I of course exclude, not only those districts which contain portions of the great Himálayan chain or its abutments, but also those which contain the inferior ranges, such as the Jhilam and Shahpúr districts intersected by the Salt Range, or the Delhi and Gurgaon districts, into which branches of the Aravalli hills extend; the mineral products of such are far more varied and interesting.

plants of the *Salsola* tribe, which abound in the "thals" or deserts during the rainy season; it is exported principally to the other districts within the province.

Alum forms a very important product and article of commerce at Kálábágh, whence it is exported to all parts of the Punjab, and is taken also to Hindústán.

In several of the large cities some chemical preparations are manufactured more or less imperfectly; at Lahore for instance, mineral acids—sulphuric, nitric, mixed nitric or *Aqua regia*, and hydrochloric, are made. Sulphate of copper, and acetate of copper ("zangár"), are produced at Amritsar, at which place, as well as at Jagádri in Ambálah, borax, brought down in a crude state from Ladákh, is refined and crystallized. At Lahore, a salt, termed "lota khár," which is a very impure cyanide of potassium, is prepared for the purpose of electro-plating; and some of the impure salts of mercury, "raskapúr," (mixture of calomel and corrosive sublimate,) and "dár chigna" (corrosive sublimate), are occasionally manufactured; as also the sulphurets of arsenic, "naushádar káni" and "hartál," and also the oxide of lead, "múrdá sang;" though the processes are unwillingly disclosed by the manufacturers. Salammoniac forms a considerable article of trade in Karnál, where the manufacture has been known for ages. "Kasís" and "kahi,"—earths containing iron in the form of an anhydrous protosulphate of iron in white satin-like crystals and in the form of a sesquisulphate, are obtained from certain bituminous shales, and are found extensively mixed with the alum shales, at Kálábágh and at Pind Dádan Khán; they form a considerable article of internal trade, being much used for dyeing purposes, and as a styptic and astringent in medicine. These are almost the only mineral products of the plain districts.

We turn next to the products of the vegetable kingdom. The rich and fertile tracts that border on the great rivers,—extending inland towards the centres of the "doabs," as far as the fecundating influences of their waters are felt,—yield annually an abundant harvest of grains of all kinds and pulse, which form the staple articles of food to the great majority of the population. As a rule, the cultivators do not consume the wheat they produce, but keep it for sale, and subsist on the pulses, barley, and inferior grains. Rice is grown in many of the plain districts, especially along the banks of the rivers. The rices of the Kangra Valley

and of Peshawur are celebrated. Of fruits that are dried as articles of trade, the number is few: the berries of the *Capparis aphylla*, the *Salvadora persica*, and some others are dried or pickled, but only for local consumption. The districts of Múltán, Dera Ghází Khán and Muzaffargarh, produce dates in large quantities; which are, however, of an inferior kind; they are preserved, either by being dried or else by being boiled in oil and water, and then dried. The dates are the produce of *Phœnix sylvestris;* unless indeed those at Multán be considered as *P. dactylifera.*

The fruits grown in the Punjab are too numerous to be inserted here, but mangoes, peaches, plums and grapes, melons, strawberries introduced from Europe, oranges, lemons, limes and citrons, are among the best.

Of spices, red pepper, turmeric, cummin, anise and coriander, are the commonest products.

Sugar-cane in several varieties is grown abundantly in well irrigated places, and the manufacture and export of molasses and sugar is large. Tobacco, cotton, and flax, also, must not be forgotten among the agricultural products which the Punjab can show.

Of dye stuffs, almost every district produces some. Indigo is cultivated in most districts, but in very small quantities and of inferior quality, except in Múltán, where it always has been in considerable repute, and is now likely to be still more so under the auspices of the Punjab Indigo Company recently established, whose out-turn of indigo promises soon to equal the manufacture of Bengal. The "Múltání nil" is an established quality of indigo with the dyers throughout the Province. Dera Ghází Khán still continues to produce this dye, it is said to have once had a very large trade in it with Khorásán; which, however, was diminished owing to the adulteration practised in the manufacture.* Another dye stuff, that is an article of trade in many of the districts, is kussumbha, or safflower (*Carthamus tinctorius*). The best is brought from the Hills, but Hushyarpúr kussumbha is a recognized variety, as second in quality, and Gujrát kussumbha is also to be had in the Lahore bazars. Other dyes, such as pomegranate-rind, dhák flowers, tún flowers, mehndi (*Lawsonia*), are produced in various districts and will receive special notice in their appropriate place.

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* Major Pollock's Report on Dera Ghází Khán.

The galls produced on *Tamarix indica*, or "farás tree," used for dyeing purposes, are largely gathered in the Jhang, Gugaira and Muzaffargarh districts, as also in the Dera Ghází Khán districts, where as much as 500 maunds are annually collected.*

Oils are largely manufactured in every district. The "assu" or tárá-amírá *(Sinapis sp.)*, "saróñ" *(Sinapis racemosa)*, "til" *(Sesamum orientale)*, and "alsi," or linseed oil, being the commonest. Almond oil is manufactured in small quantities at a very high price, and oils expressed from the seeds of cotton, from various species of gourd and melon, from the seeds of the safflower, and from poppy seed, are also to be obtained; the other oils are prepared principally for medicinal purposes by the druggists of the larger cities.

Gums are produced, but not in any thing like the variety in which they occur in the southern provinces. Most of these that are medicinal or fragrant are imported, and will be noticed in our account of the Hindústán and North West Frontier produce. Gum of the *Acacia arabica* is common, the best comes from Delhi, though it is capable of being produced of excellent quality in other districts. The "siris" (*Acacia serissa*), yields a coarse gum used by calico printers. The "dhák" yields an astringent gum much used in medicine, and is said to be produced about Thanesar, Ambálah, and some adjacent localities where there are large jungles covered with dhák trees. Lac is produced in many districts, especially in Núrpúr, in the Kangra valley, and in Kapúrthalla, where the insect lives on the dhák tree, just mentioned.

Of drugs used by the native practitioners, not a few are the common produce of nearly all districts in the Punjab, but a considerable number are brought from the Hills, and others come from Afghánistán, Kábul, and Turkistán, as far as the borders of Russian territory.† The remaining drugs in use are imported from Central and Southern India, from the islands, or from the Persian Gulf. Delhi and Amritsar are the central markets for imported medicines.

Of wools and silks, the finer kinds are not the produce of the Plains,

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* MAJOR POLLOCK'S Report on Dera Ghází Khán.

† The "gillar patr," a sea-weed (*Laminaria*), used as a drug, is an instance of this. It is obtained solely *vid* Yarkand, from the shores of the Caspian sea. CUNNINGHAM, in his "Ladákh," has made a great mistake about this drug; he calls it a stone! the word is "*patr*," a leaf, not "*pat-thar*," a stone.

but goats' hair and common sheeps' wool, form articles of internal production and distribution.

The cultivation of silk in Gúrdaspur and Peshawur may still be said to be experimental,—but there is every hope of this product becoming a staple one of the sub-montane, if not of several of the Plain, districts. Already Gujrát, Shahpúr, Lahore, and Amritsar, have taken up the subject; and the experiments, as far as they have gone, have been most promising.

Of Manufactured Articles in use in the province, the great majority are produced within the Punjab, a few are however brought in by the N. W. Frontier trade. The demand for European piece goods, and for various other articles of European manufacture, useful and ornamental, is daily increasing.

Within the province, several cities and districts have become celebraed for particular manufactures; and native society, ever slow to change, maintains the distinction, although many other places might, and indeed to some extent do, produce equally well the very same articles.

Cotton goods are of universal manufacture, but the Jálandhar Doab is especially celebrated for its cotton fabrics, and among them the "gháti," or diaper cloth. The fine cotton "lungis," of Peshawur and the carpets of the Derajāt, are also remarkable. Umbrellas are manufactured in the Jálandhar Doab.

Múltán, Baháwalpúr, and Lahore, have long been celebrated for silks; Baháwalpúr especially for its figured and fancy silks, and Lahore for striped and plain silk pieces. Pattiala, Gúrdaspúr, Shahpúr, Peshawur, Ludhiana and Amritsar, also manufacture silks.

Woollen fabrics are not much made in the plains except coarse blankets. The best come from Rohtak, but the produce of Sirsa and Leia is by no means despicable.

Pashmina fabrics, embroidered with silk, and plain pashmina cloths, are produced extensively at Amritsar and Ludhiana, and a few at Lahore. Shawl weaving, an art introduced by emigrated colonies of Kashmíris, is practised at the same cities, as also at Núrpúr and Adínanagar, but with greatest success at Amritsar; none of these cities, however, equal either in fineness of texture or beauty of colors and design, the genuine fabrics of Kashmír. The shawl weaving of Gujrát and Gúrdaspúr is quite inferior. In Lahore, shawls are made from "Kábuli pashm," a wool which

is inferior to the Thibetan shawl wool. These shawls are plain and not patterned like the others. They are called "Lahorí cháddar."*

Lahore and Delhi are noted for their gold woven fabrics, and light silk muslin fabrics interwoven with gold threads, as well as for all kinds of work in tinsel or kalábatún.

The art of embroidery is one very consonant with the habits of the people; their patience and delicate handling render success certain, and there is scarcely a town or city where creditable embroidery cannot be found. But Delhi† is the great place for embroidered fabrics both in silk and gold threads. In Lahore and Amritsar the manufacture of "kalábatún," or gold thread, is extensively carried on.

Most of the large cities manufacture vessels of brass and other alloyed metals; for smaller work they prepare the alloy in their own "kuthális," or crucibles; for making the larger sizes they perfer the fine sheet metals imported from Europe.

The manufacture of armour,—swords, guns, and the like,—once had its grand centre at Lahore; but when the Sikh rule passed away, the demand ceased. Of the cutlers some are still in existence and can work; many of them have settled at Nizámábád in the Gujranwalla district (their manufactures were well represented in the Exhibition), others have gone to Gujrát, the cutlery of which place is noted; and the "koftgars," who used to inlay with gold the shields and armour of the Sikh chieftains, by hammering, with consummate skill, gold wire in various patterns into the steel surface, have mostly left Lahore for the Kotli Lohárán in the Sealkot district. They have recently also gone into the Gujrát and Gujranwallá districts, where they develope their art in works of peace; and now instead of Sikh armour, inlay caskets, studs, vases, paper-cutters, letter weights, and other fancy articles. There are still persons at Lahore who can work magnificently in inlaid armour, and do so occasionally at the call of the collectors of articles of vertu; but in Lahore it is almost impossible to get the articles above enumerated as made at Sealkot, Gujrát or Nizámábád.

Much encouragement has recently been given to this beautiful art; and

* The wool is the produce of the Dumba sheep.

† This is said only with reference to the Punjab itself; the embroidery and needle-work, "amlikar," of Kashmir, both in gold thread, silk, and pashmina, is quite unequalled.

the subject is well worthy the attention of European merchants, as these articles find a ready sale at home. Most of the native workmen are however poor, and require the assistance of pecuniary advances to carry on the work; and, as they have but little originality as to the *form* of articles, it is desirable to furnish them with full size drawings, such as of caskets, candlesticks, vases, inkstands, &c.; with the help of these the most beautiful specimens of this art may be produced.

Ivory painting is carried on with unequalled success at Delhi, as is also the art of making jewellery in the European fashion. Enamelling of great beauty is executed at Múltán, and also in the Kangra district. Here, as in all other countries, the localization of peculiar manufactures in districts and even within the confines of a single village is observable.

A more minute account of the most remarkable of these manufactures will be found in the appropriate class and section in the following Handbook, they are only mentioned here in passing, with a view to afford an idea of the general products of the province.

2nd.—The produce of the Hills next demands attention; it is not very extensive in either raw or manufactured departments, but nevertheless the articles of hill trade are of considerable value and importance. They come by those routes which are most practicable, and where the extreme difficulty or cost of carriage does not render their import unremunerative. The districts taken into consideration under this head are the Himálayan districts, Chamba, Kúlú, Lahaul, Kanáwar, Spiti, and the Simla States; the other districts traversed by inferior ranges, are Peshawur, the Derajá t, Rawalpindi, Jhilam, Shahpúr, Delhi, Gurgaon, Hissár, &c.

One of the most valuable imports is the Thibetan shawl wool, which supplies the shawl weaving cities of Amritsar, Gujrát, &c., this comes from Chángthán *viá* Lé and Rámpúr. Wool, the produce of Rámpúr itself, is also imported.

From the Himalayan range comes iron, principally from the Suket and Mandi mines, the road for the Chamba iron being not yet sufficiently easy to make the import remunerative; some antimony is imported also. Copper is found in Kashmír, but is not yet an article of trade. Lead is also worked at Jammú, and large quantities of galena or lead ore are imported from Kábul and Kandahár; this is principally imported in lieu of antimony, (from which natives do not distinguish it), and being reserved for medicinal purposes, finds its way only to the druggists.

Slates are occasionally brought down, and will be more frequently so as the roads are improved and the quarries worked more cheaply; they are of excellent quality.

Of edible products, ginger, the best turmeric, walnuts, apples, and pears, apricots, the nuts of the edible pine, *(Pinus gerardiana,)* the 'zira siya," or carraway, *(Carum nigrum)*; and a considerable number of vegetable drugs, consisting of plants, ferns, and even lichens, form the staple articles of import. Among these may be mentioned chiretta, "sálip," rhubarb, extract of berberry, ("rasaut,") the pachet root or costus, violets, aconite, nux vomica, and spikenard.

The Kangra district has a great export trade in rice, of which the most esteemed kind is the "básmati." Peshawur is similarly productive, but it is principally celebrated for the "bára" or scented rice, grown on the banks of the Bára river, which is exported and commands a high price.

Of dyes, the best kussumbha or safflower, akal-bír (the root of *Daliscus cannabinas*), kamela, (the powder from the capsules of *Rottlera tinctoria*), and harsinghár (flowers of *Nyctanthes tristis*), are the most important. A madder root is also common; it is, however, doubtful if this will equal the Ghazni madder. European enterprize has begun to take notice of the valuable fibres yielded by many hill plants, the nettle, the rozelle, the hill hemp, and others. Many other valuable plants are being tried, among which hops may be mentioned. It will be almost unnecessary to add to the list of Hill products the huge logs of deodar cedar, of the *Pinus excelsa,* and a few others upon which the districts of the plains, the railways and factories are entirely dependent. They are floated down on the great rivers, from the mountain forests that are within reach of their banks.

The pine forests also yield tar, resin, and might yield turpentine, except that by the native process of preparation, this most valuable product of the crude resin is allowed to evaporate.

The tea plantations now flourishing in many parts of the Hills must not be forgotten: nor will it be easy to over-estimate the value of their produce, if only it can be made to find favor in Kashmír and other parts, so as to supplant the costly and deficient import of Chinese tea across the frontier of Thibet.

Kúlú produces opium. The British districts of Spiti and Lahaul have

but little trade. Spiti appears well suited in every respect for the production of shawl wool; but its sterility is a drawback as to pasturage.* Kanáwar is just to the south of Spiti, having as its capital Rámpúr, a place noted for its wools.† An annual fair is held there. Rámpúr is also an emporium for borax which passes thence to Káráchí; and also, as before mentioned, for the shawl wool which supplies the Punjab.

The manufactures of the Himálayan hill districts consist almost exclusively of woollen fabrics, and the samples exhibited show that they are of very considerable excellence. At Kangra, enamelling on silver is a trade practised with great success, and the goldsmiths are skilful, especially in the imitation of European articles. At Simla, embroidery in leather is practised.

The Hills in the other parts of the Punjab are not without their products. The low ranges around Delhi and Gurgaon, yield building stone, sandstone, and marble. At Aurangpúr crystal is found. In Gurgaon there is iron, in Hissár there is copper, the small ingots of which are rarely to be met with in the bazars of the upper districts; a handsome gray mottled marble, and a curious flexible sandstone are produced in the same Hills. The products of the Salt Range are well known; the name is derived from those wonderful mines and quarries of solid rock salt which supply the whole province; besides this, the same range produces limestones suitable for building, iron,‡ coal or lignite, pure sulphur (made at Kuhát), gypsum,§ convertible into plaster of Paris, and also alum at Kutkí and Kálábágh, and "kahi," or sulphate of iron earth, and gold dust. Petroleum also is attracting attention in these hills.

Of the products of the Sulaimaní Hills, we have but little information;

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* Spiti has a peculiar importance as being the only portion of British Territory bordering on Chinese Thibet. Mr. Philip Egerton has discussed the possibilities of a trade route through this province, in the Appendix to his "Journal of a Tour through Spiti" (Cundall and Downes, London, 1864,) a book which will well repay perusal, both from the interest of its subject matter and the beauty of the large photographs which illustrate it.

† Fine samples of iron, hill hemp, and also a good tobacco from Rámpúr have been exhibited by Mr. Ter Arratoon of Lahore. Much information respecting the interesting district of Kanáwar, will be found in Gerrard's "Account of Kanáwar," 1833.

‡ A new discovery of a first-class iron, in hills belonging to this series, is due to the energy of Dr. Henderson, Civil Surgeon of Shahpúr, who not only found out the ore, but did not rest till he had experimentally smelted a quantity and forged bars of the metal. The Engineers of the Railway have pronounced this iron excellent.

§ Gypsum, occurs as selenite,—as fibrous gypsum,—as a hard granular gypsum, which takes a polish like marble,—and as a softer stone useful for calcination to form plaster of Paris.

at Dera Ghází Khán a kind of ochreous marl, called Múltání matti, is imported from the Hills, to the extent of 10,000 maunds a year.* Some lignite and some crystals of sulphur, gypsum, limestone, and iron ore are among the samples contributed from hills belonging to this range. Of vegetable products, some madder is grown in the hills of the Dera Ismaíl Khán border.

The "khair," (*Acacia catechu*,) which yields "kath," or catechu, grows in several Hill States. This tree is noticed by CAPTAIN BARNES, as a tree of the Kangra district, and it grows also in greater or less abundance in the lower hills, † as also in the Yusufzai and Peshawur, but the manufacture of the astringent extract is confined almost entirely to the eastern Himálaya at Kumaon, and other places beyond the Punjab. The other hill products of Ladákh, &c., are included under the head of Kashmír imports.

In concluding the notice of products directly referable to the Punjab itself, it will be interesting to examine the lists of the articles imported into the larger trading cities, both in the upper and the lower parts of the province—this will give a good idea of the interchange of articles of commerce. I have obtained for this purpose returns from Lahore, Amritsar, and Ludhiana, as representing the upper and lower portions of the province: the other great cities situated at the extremes of the country are less satisfactory for this purpose. Take for instance, Peshawur and Delhi;—the former receives almost exclusively the imports of the North Western trade, to be noticed hereafter, and only such things from the Punjab as are only obtainable southward. Delhi again is the mart for all the Hindústán trade from Jhansi, Ulwar, Patna, Gwalior, and other places, as also for commodities imported *viâ* Calcutta.

The characteristics of the internal trade of the Punjab will therefore best be ascertained from the import lists of the more central cities, which are not specially devoted to trade from one quarter more than another.

To commence with Amritsar. The following list of articles imported

* POLLOCK's Report on Dera Ghází Khán. It would seem that several descriptions of earth are included in this account, one being the yellow marl alluded to, another being a kind of fuller's earth; *see*, however the sequel in Class I., under head of "Earths."

† I have seen this tree all up the lower valley of the Rávi. In the Kangra district there are not a few catechu trees around Núrpúr, in which city there is a great trade in red leather; the astringent wood of the tree is used in the manufacture.

has been compiled from the Octroi papers of the city. The list is not exhaustive, and merely gives the principal articles.

Alum.
Antimony.
Drugs.
Glass beads, &c., from Delhi.
Gums, principally katíra and kíkar.
"Kharya mitti" (fireclay, used for making crucibles), from Múltán.
Charcoal.
Horse hair.
Lakh (lac-dye and resin).
Mats and punkahs of "patha," from Peshawur (in large quantites).
Madder (Affghánistán), *viá* Dera Ismaíl Khán, &c., and Múltán.
Fruits (Kábul).
Dye stuffs.
Fishing tackle.
Salt (Shahpúr, Pind Dádan Khán, from the Salt Range).
Raw silk (largely).
Wool.
Umbrellas (made towards Jálandhar Doab).
Soap.
Canes.
Sugar.
"Kalái," whiteing.
Tea (Calcutta). Hill tea is scarcely at all imported for native consumption. Thibet or China brick tea brought overland is a rarity.
Timber (Hills).
Tobacco.
Wax (Hills).
Vinegar (Delhi).

The Bombay and Calcutta goods are represented by—

European fabrics, such as cotton goods of sorts — prints, chintzes, muslins, long cloth, calico, Turkey red cloth, &c., broadcloth, silk, velvet, &c., &c.
Glass-ware and porcelain.
Window glass.
Gums and assafœtida (Bombay).
Tea and Coffee (Bombay and Calcutta).
Iron (Bombay) and other metals—brass, zinc, and copper.
Gunny bags and taut (Calcutta).
Spices (Bombay and Calcutta).
Cocoa-nuts and kernels called "naryel" and "khopa," respectively.
Ivory, probably from the Himáláyan 'tarai' but also from abroad.
Jewels, including pearls (Ceylon and Persian Gulf, *viá* Calcutta and Bombay).
Cowries (shells used as coin). Bombay, Calcutta and Káráchí.
Corks (Calcutta).
Indian rubber.
Cutlery (Bombay).
Safeda (carbonate of lead).
Chrome yellow, "peori wilayti."
Prussian-blue, "níl wilayti."
Bichromate of potash, "kahi surkh."
Caustic.
Sulphate of copper, "nila tútya."

The imports into the city of Lahore are here given, as they are in a very complete form, as to the locality whence they are imported. The Calcutta goods include both European imports and the produce of Bengal:—

Bengal or Southern and Central Indian Produce—

Black pepper.
Long pepper or cubebs.
Betel nuts.
Cinnamon.
Cocoa-nuts, shells, and also the kernels (khopa).
Pán leaves, &c.
Nutmegs.
Cardamoms.
Mace.
Cochineal.
Bengal indigo.
Cloves.
Dates.
Coarse silk.

Foreign imports coming *viâ* Calcutta—

Europe piece goods.
Fancy ware.
Glass.
Coffee.
Sago.
Tea.
Vitriol, blue.
Red lead.
Arsenic (white and yellow).
Safeda (white lead).
Thread.
Ivory.

From Bombay—

Tin.
Zinc.
Lead.
Copper.
Iron.
Brass (sheet).
Sulphur (vitreous and roll).
Lubán (benzoin), two kinds.
Sundras (Indian copal).
Bakam wood (red dyeing wood).

DRUGS.
" Akarkarha."
Oak galls (májuphal).
Surinján *(Colchicum)*.
Tirwi.
" Samundar khág" (dorsal bone of cuttle fish).
Gauzabán.

Sandal wool.
Cochineal.
Surma (antimony).

By the internal trade, including Kashmír, the imports are—

Saffron.
Sealkot paper.
Oil.
Native thread.

DRUGS.
" Kuth," or costus root.
" Thotha," or spurious costus root.
" Chok,"   "   "

Native tabacco.
Mats and punkas, from Peshawur.
" Mauli surkh " (colored thread in skeins).
Sajji (soda).
Gach and pándo (whiteing).
Charcoal.
Silk pieces.
" Náfakasturí " (musk balls.)
Kashmír paper.
" Chikri " or boxwood.
Cotton.
Bamboos.
" Akal-bír " (yellow dye).
" Kussumbha " (safflower).
" Bán munj," leaves from the flower stalks of *Saccharum munja.*
" Sirki and kánná," stems of *S. munja.*
Hides (taurí).
Felt (namdah).
Willow flower water ('arak-bed mushk).
Silken leashes and girdles.
Legs of charpoys (lacquered).

From Hindústán—

"Keora," a perfume (essence of *Pandanus odoratissimus.*)
Sandal wood oil.
"Attars."
Rosewater.
Iron from Gwalior.
Gil-i-zard, yellow earth from Gwalior.
Geru, red earth.
Kharú-mitti (a fire clay, like soapstone).

To add yet another list, the city of Ludhiana will fairly represent the cities near the Hindústán frontier. A very complete list showing the value of one year's import of each article as well as the localities of production, has been obligingly furnished by the Deputy Commissioner. It will be noticed that there is a large increase over the former list in Bengal and Hindústán imports, and a decrease in the Bombay goods.

The Kábul trade is represented by—

Imported yearly.	From	Value—Rupees.
Madder root, ...	Ghazní and Khandáhar,	15,000
Almonds, ...	" "	10,000
Kishmish* (small raisins without seeds), ...	" "	4,000
Munakka (raisins), ...	" "	1,000
Pistachio nuts, ...	" "	2,000

The internal trade with various districts of the Punjab, and including the various Hill States is as follows :—

Imported yearly.	From	Value—Rupees.
Rice of kinds, ...	Kangra, 1 lakh; Delhi, 40,000,	1,40,000
Leather and shoes, ...	Delhi, 6,000; Punjab, 8,000,	14,000
Alum, ...	Lahore, Kálábágh,	4,000
Dry ginger, ...	Hills,	2,000
Country indigo, ...	Punjab, Ludhiana district, Pattiala, and Nábha,	20,000
Turmeric, ...	Hills, 5,000; Bengal, 5,000,	10,000
Kussumbha (safflower), ...	Hills, 2,500; Bengal, 2,500,	5,000

* *Kishmish* are the small sweet seedless raisins which are so commonly seen in the Punjab, they are called sultana raisins by European grocers. *Munakka* are common dried grapes, or pudding raisins.

Imported yearly.	From	Value—Rupees.
Bamboos, ...	Hills,	500
Bán munj, for string, &c., ...	Punjab *viá* Firozpúr, ...	700
Vegetables of all kinds, ...	Punjab, 19,000; Bengal, 6,000,	25,000
Wood and timber, ...	Punjab, 3,500; Bengal, 2,000,...	5,500
"Charras," ...	Rámpúr, Bishahr, &c., ...	325
Bhang, ...	Hushyarpúr district, ...	125
Opium, ...	Rámpúr, Bishahr, ...	800
Poppy heads, ...	District of Ludhiana, ...	2,500
Grain of all kinds, ...	Punjab *viá* Firozpúr, and District of Ludhiana, ...	2,00,000
Ghì, ...	Kurnál, &c., ...	25,000
Brown and pale molasses, ...	Jálandhar and Ludhiana districts,	50,000
Moist sugar (shakar tari), ...	Jálandhar and Ludhiana districts,	...
Oil (rape, &c., &c.), ...	Ludhiana district, ...	25,000
Seasamum (til), ...	Punjab *viá* Firozpúr and Ludhiana district, ...	25,000
Cotton, ...	Ambálah, Pattiala, Nábha, and Ludhiana district, ...	6,00,000
Gold ribbons, lace, edging, &c.,	Delhi and Pattiala, ...	70,000
Tobacco, ...	District villages, 4,000; Bengal, 1,000, ...	5,000
"San" fibre, ...	The district villages, ...	25,000
Gums, ...	Punjab, ...	3,000
Ivory, ...	*Viá* the Punjab (from Bombay?)	10,000
Lac, ...	Punjab, ...	10,000
"Má'ín," galls of tamarisk, ...	Múltán, ...	2,000
Blanket and woollen goods, ...	Punjab, ...	50,000
Cotton cloths (native), ...	Punjab, ...	50,000
Earthen and China vessels, ...	Punjab, 3,000; Bengal, 2,000....	5,000

The trade with Hindústán and Bengal is represented by the following list, which includes also European goods coming from Calcutta, and the reader should bear in mind that the term Bengal in this list is a translation of "Púrb," which is in the Punjab applied very loosely, and may signify all the countries near Bengal, and including even the North Western Provinces.

Imported yearly.	From	Value—Rupees.
European fancy goods, ...	From Bombay, 4,000; Calcutta and Delhi, 8,000, ...	12,000
Tea, ...	Calcutta and Bengal, ...	30,000
Black pepper, ...	Calcutta and Bengal, ...	5,000
Turmeric, ...	Half from Bengal and half from Punjab, hills *(vid. supra)*,	19,000
Cocoa nut kernels (khopa), ...	Bengal, ...	2,000
Dates, ...	Bengal, ...	2,000
Indigo, prepared by European method, ...	Bengal and Khúrja, N.W. Provinces, ...	1,900
Betel nuts, ...	Bengal, ...	2,000
Cardamoms, ...	Calcutta, ...	20,000
Cloves, ..	Calcutta, ...	1,000
Long pepper, with spices generally, ...	Calcutta, ...	30,000
Kussumbha, ...	Half from the Punjab hills, and half from Bengal, ...	5,000
Copper vessels, ...	Bengal, ...	10,000
Iron and hardware, ...	Calcutta, ...	15,000
Gold mohurs, ...	Calcutta, ...	1,00,000
Silver coins, &c., ...	Calcutta, ...	1,00,000
Murádí pice, ...	Calcutta and from places where they are cheap, ...	50,000
Kauris (cowrie shells used as coin), ...	Bengal, ...	2,000
Corals and pearls, ...	*Viá* Calcutta, &c., ...	25,000
Coffee, ...	*Viá* Calcutta, ...	1,000
Babbar grass, for mats, &c., ...	Bengal, ...	1,590
European piece goods, ...	*Viá* Calcutta, ...	70,000
Vegetables of kinds, ...	Punjab, 19,000; Bengal, 6,000; (*vid. supra*), ...	25,000
Wood and timber, ...	Punjab, 3,500; Bengal, 2,000,...	5,500
Lead, ...	Calcutta, &c., ...	5,000
Silk fabrics, ...	Bengal, ...	25,000
Tobacco, ...	1,000 from Bengal, rest from district villages (*vid. supra*),	5,000
Earthen and China vessels, ...	3,000 from Punjab; 2,000 from Bengal (*vid. supra*), ...	5,000
Precious stones, ...	Bengal, ...	10,000
"Attars" and perfumery, ...	Bengal, ...	500

The total of these values (excluding articles repeated in the lists, as produced in different places) gives as one year's import to the city, Rs. 20,59,450, of which Rs. 14,46,450 comes by way of the Punjab, and Rs. 6,13,000, by Bengal, &c.

II.—We now come to the products imported by the Khaibar and other Passes on the N. W. Frontier, comprising the products of Kábul, Bukhára, &c., &c.

The trade and resources of these countries have already formed the subject of an able Report, by Mr. R. H. Davies, in 1862. The report is also illustrated by a number of appendices containing memoranda on particular products, and statistical tables of great value and interest.

In this place, therefore, it will be sufficient in taking a rapid glance at these sources of trade, to notice only the principal articles imported, referring the reader for detail to the work just alluded to.

The countries from which this trade is derived are seen on the map to skirt the whole of our Western Frontier, and extend northward one beyond the other, the northern boundary of the lowest forming the southern boundary of the next province, from the sea coast of Bilúchistán to the plains of Independent Tartary, bordering on the Orenburgh and Orusk frontiers of Western Siberia.

The products of these several regions find their way into the Punjab through the Passes of the Khaibar Hills, near the Safaid Koh, and also through those of the Sulaimání Range further south. The imports consist of the products of these localities as well as those commodities which come through them from Khokán, from Yarkand and China, and also from Russia,* and through the Kábul provinces from Persia. These

* The following is a list of Russian articles found in 1838 in the Bazar at Kábul; but as this was 25 years ago, it is probable that a number of the articles have ceased to be imported, the trade from Europe by Bombay and Calcutta having supplied the demand more cheaply and more easily :—

Gold-dust.
Russia gold coin and ducats, called "budki."
Muskets, pistols.
Gunlocks.
Padlocks.
Knives and razors.
Iron and brass wares.
Copper. (The import has been supplanted by European trade).
Russian snuff-boxes, &c.
Needles.
Glass, spectacles, and mirrors.
Porcelain.
Flints.
Beads and Corals (taken to India).
"Surapech" (fish-bone).
Paper.
Tea.
Kimsan (a kind of leather.)
Kirmiz (cochineal).
Sulphate of copper.
Iron trays.
Imitation gold wire, or kalábatún.
Broadcloth.

territories, beginning south on the shores of the Gulf of India and the Arabian Sea, and going northwards are first, Bilúchistán, with its Passes the Bolan, the Mulla, and the Guleri, by which the trade of Afghánistán, passes into Sindh. Above that comes Afghánistán, including the provinces of Kandahár, Kábul, Herát, and the provinces beyond the Hindú-Kúsh, —Bádákshán, Balhk, and Kundúz,—these receive the trade from Turkistán and Khorásán, from Persia, Tahrán and Yazd. Above these provinces are Khiva, Bukhára, and Khokán,—the great Azbak plains through which the river Sihún and Jihún (Oxus and Jaxartes) flow; these take in the products of Central Asia and Independent Tartary, and also from the centre to which the caravans from Troitska, Orenburgh, and Novo Iletsk, from Petropavolosk and Semapalatinsk introduce the iron, gold, porcelain, and other products of Russia, while the Khokán province represents the trade with Yarkand and China.

On the East of Bukhára and South of Khokán extends the Chinese frontier, represented by the provinces of Káshgár, Yarkand and Khutan, whose capital is Ilchí.

It now remains to enumerate the produce of these provinces, and to indicate the route by which they gain access to our territories.

The trade of Bilúchistán and Afghánistán comes to the valley of the Indus through the Bolan pass, which is below the Punjab and opens on to Sindh,—through the Guleri or Ghawelra, or Gúmmul pass, at Dera Ismaíl Khán,—and through the Tátra, Abkhána and Khaibar passes, at Peshawur. The last named pass is somewhat dreaded on account of the depredations of the Afrídí tribes, otherwise the road is quite practicable.

The principal Afghán traders are called Povindahs, of whom there are several grades or classes; the Lohanis also are a trading caste; they enter the Deraját, and carry on their merchandize to Múltán, from whence parties branch off to Delhi, Benares and Calcutta, and some to Lahore and Amritsar.

The greater part of the Bukhára trade comes by way of Peshawur;

Chints (of sorts).
Velvet. (The import of this article has now ceased).
"Atlas," satin.
"Khudbaft," soft silk fabric made for shawls.
"Shirja" (colored cloth).
"Kaitán" (muslin).
"Nanka" (Nankin).
White cloth.
Handkerchiefs.
Chapan-i-kard (woollen jacket).
Bukhára silk, and silk from Kundúz.

[*Extracted from Appendix*, No. 1., *to Mr. Davies' Report.*]

there is a trading tribe of Parachalis, and the merchandize is carried by Kábulis, Tájiks, and some of the Khaibar tribes.*

The Afghánistán trade produces the following articles—

FROM BUKHARA AND TURKISTAN.

Raw silk of various kinds, called "chilla jaidar," "vardanzwí," "lab-i-ábi," chúrkhí," from Khokán, Balkh, Kundúz, Akcha, Shibarghan, &c.
Horses.
Samarkand charras (hemp resin).
Turanjbín (manna).
Shawl wool, "pat."†
Kirmáni wool.
Bukhára gold coins, "budki" and "tilá."

RUSSIAN.

Furs.
Gold coins.
"Kalábatún" (imitation).

KABUL PRODUCE.

Pistachio nuts.
Kishmish (small seedless raisins).
Munakka (dried grapes).
Almonds.
Pomegranates of Jalálábád.
Melons, "sardah."
Grapes, picked and packed in round boxes between cotton wool (called "angúr khattí").
Dried mulberries.
Nák (pears).
"Nandrámi" (rupees of Kábul).
"Bozgand" (galls of *Pistacia terebinthus*).
"Magz khumáni," apricot kernels.
"Sherkhisht" (kind of manna).
Asafœtida.
Alu bukhára (prunes).
Zira siya (carraways).
Safflower.
Pashmina pattú (cloth).
Postíns (sheep-skins).
"Bark," camel-hair cloth.
"Kark," goat's wool cloth.
"Dallah khafak" (skins).

KANDAHAR PRODUCE.

Pomegranates.
Figs "(anjir)."
Dried fruits.
"Sherkhisht" (manna).
"S'alab misri" (salep).
Asafœtida (red and white).
"Kúlah arkchin," embroidered caps.

PRODUCE OF HERAT, MASHAD, AND PERSIA, PURCHASED AT KANDAHAR.

Carpets, made at these places.
Turquoises (Persian).
"'Unáb," or jujube fruit, from Herat.
Zirishk (currants).
Pashm thread (used in shawl-weaving).
Saffron.
"Asbarg" (a dye, to produce a yellow for silk).
Herat piece silks (Kanáwez).
Cat-gut for bowstrings.

DRUGS.
"Bíhidána" (quince seeds).
"Shakákul misrí" (a medicinal root).
"Gul-i-guláb" (rose-flowers).
"Gul-i-banafasha" (violet).
"Gau-zabán."
"Surma," antimony and lead ore (used only medicinally).
"Indarlatíb."
"Anárdána," pomegranate-seeds from Jalálábád.
"Bahman lál," a herb.
"Bahman safed."

* See Appendix XVI. of MR. DAVIES' Report, where the most interesting information is given in a series of replies by NAWAB FAUJDAR KHAN.

† "Pat" is the wool of a goat abounding in these parts, but inferior to the real pashmina or shawl wool of Thibet.

ARTICLES PURCHASED AT GHAZNI.

Madder, "rodang" or "majíth."
Sheeps' wool.
Liquorice (mulatthí).
Alu Bukhára (prunes).
Kábul rice.
"Zúfa" (a drug).
"Simagh 'Arabi" (gum-arabic).
Ghí (clarified butter).
Chilgoza (seeds of *Pinus gerardiana*).
Pudína (mint).
"Shorapez" (fish-bone used for sword handles).
Rewand chíní (rhubarb).
"Kurt," dry milk curds.

Besides these, the drugs, kásní, shevadára, káhú, ghárikún (a kind of fungus), and the gums, mustagí rúmí (mastich) and katíra are brought from Kábul.

III. We have now to notice the Kashmír trade, including the produce of Yarkand and Khutan, and other remote provinces, which comes by the route of Lé, &c., and also the imports from Ladákh and Lahaul.

The Kashmír territory comprehends Jammú, Kashmír, Kishtwár, Zangskár, Ladákh, and Balti. Some valuable raw products are to be found in Jammú,* but commerce is chiefly carried on in the valley of Kashmír.

The principal routes by which the merchandize of Kashmir enters India are, from Srínagar, by the Bahnihál pass to Jammú and Amritsar; by the Pir Panjál and Bhimbar to Gujrát; also by Akhnúr and the Búdhil pass; and lastly, from Srínagar to Peshawur by Manserah, Muzafarábád and Báramullá.

The great Punjab mart for Kashmír is Amritsar.

The largest import is of pashmina goods, consisting of shawls, needle-worked goods (amlikár), embroidered chogas, &c., and plain pashmina cloth. The following is a list of the principal articles of export from Kashmír; it is followed by a list of those articles which are the produce of the remote provinces of Rudokh, Ladákh, Zangskár, Balti, Rúpshú, Chángthán, Khutan, and Yarkand, which come *viâ* Lé.

Shawls of kinds—square, long, and double, both woven and worked by hand (the latter being called "amlikar").
Embroidered pashmina pattú, and plain piece pashminas of all kinds.
Ghafrán (saffron).
Bíhidána (quince seed).
Charas (garda bhang), the resin of the hemp plant from Yarkand.

DRUGS.
"Chob-kút," the *costus* or scented root.
Barting *(Embilia ribes)*.
Kanaucha.
Aftímún.
Warch.
Gul-í-banafsha, violet flowers.
Guchchhí (a kind of morel).
Zira siya *(Carum nigrum)*.

Pears and apples of Kashmír.
"Gabba," carpets.

* Such as lead and coal.

Woollen chadars.
Shoes of "kimúkht leather (a green morocco like leather).
Kashmír paper.
Conserve of violets "gulkand banafsha," "'Ark bedmushk," or willow-flower distilled water.
Walnuts.
Dried grapes.
Singhára (fruit of the water caltrop, used like arrowroot).
Phúlí, a salt used with tea.
Currants.
Yarkand ponies, &c.
"Kalgis" (plumes of the black feather of a kind of heron, peculiar to Kashmír, called oṅkár.
Papier maché work, called "kár-i-kalamdání," and painted wooden articles.
Guns and pistols made of Bajaur iron.
"Bidri" work, hukas, &c.
Lac.
Tobacco.
Poppy heads.
Chintz.

The trade of Lé, Yarkand, and Khutan, is represented by the following articles—

Shawl wool, produced in a variety of districts in Thibet.
Chángthán wool.
Gold of Khutan and Bukhára.
Tea in cakes, both black and green (called "dhamún"—this goes to Kashmír only).
Khutan silk* and some brocades. Velvet used to be imported from Russia, but is not so now; the direct English imports having no doubt supplanted the trade.
Khutan carpets.
"Pattú," white woollen cloth.
Sulphur from Yarkand.
Soap from ditto.
DRUGS.
Gul-i-dár chiní.
Mámírán-i-chiní.
Chob chíní (*Smilax china*).
Rewand chíní.
Bádián khatai.
Naushádar.
Nirbisi (Zedoary).
DRUGS.
Shákh-i-'ambar, from Lhassa (aromatic sticks used as pastilles).
Gillar-patr, Yarkand. 5 or 6 maunds are imported.
Borax from Pugá in Ladákh (called Tsalé in Thibetan).
Kalábatún (imitation) Russian.
"Phúlí" from Nubra valley in Ladákh (a salt used in infusing tea).
Chángthán salt.
Chowries, or yak's tails from Yarkand.
Coral (Central Asia and China), from Chángthán.
Turquoises.
Jade, and lapis-lazuli from Bádákshán.
"Balghár," Russia leather.
"Kimúkht," turquoise green leather, Yarkand.
"Kímsana," bronze leather.
Copper tea-pots or vases, from Yarkand.
Tobacco, from Yarkand.

The route to Amritsar *viá* Ladákh is that which brings the trade of Yarkand and Eastern Turkistán. There is also a route from Amritsar, Jálandhar or Ludhiana *viá* Núrpúr, Mandi, and Kúlú, to the same places.

* These silks are of the kinds bádsháhi (striped silk), ilchi (spotted), and mashrú (striped satin).

There is a trade with Lhassa, which now appears to have diminished exceedingly.

The chief imports from Eastern Turkistán and the Chinese territory are pashm, tea, charras, silk (not very much comes now), silver, gold, borax, sulphur, ponies. "The exports through Ladákh," writes CAPT. MONTGOMERIE, "used to amount to the value of about 3 lakhs; it is doubtful whether it now reaches $1\frac{1}{2}$ lakhs. The goods exported are in excess of the imports, the difference being made up by the importation of gold and silver." A large portion of the traffic of Ladákh, he adds, is only diverted to other and more difficult roads; it is well known that the Chinese send a great many things down the Sutlej, avoiding the Jammú Maharaja's territories altogether.

The great articles of trade in Ladákh is the shawl wool, from the further provinces. The districts of Khutan produce jade, emeralds, copper, lead, and sulphur.

IV.—The articles imported from HINDUSTAN are next to be considered, excluding however the products of Delhi, Gurgaon, and Hissár, which are territorially within the Punjab, and which have been noticed under the first head.

This class does not include those articles which, albeit they are produced within some province of India, only reach the Punjab *viâ* Calcutta and Bombay, by sea. The class will therefore consist of but a few articles, such as the following:—

Iron is brought from Gwalior. The varieties are known as guléri and "khéri." Steel was once imported but has now ceased to be a regular article of trade. Geru, a red earth, and gil-i-zard, an ochre used in dyeing, are still imported; and orpiment, realgar (mansil), and cinnabar (shingarf), are said to come from Central India. The marbles and building stones, and the red sand stone so commonly seen in all ancient buildings from Benares up to Lahore, were formerly imported from these parts by the sovereigns who constructed them; and the magnificent mosques, tombs, and shrines, yet remain to tell us that such a trade was, but is no more. The architects of this period are satisfied with neat utility, and condescend to bricks, stucco, and chunam.

A few articles are brought from Bengal—such as dates, cocoa-nuts, both the kernels, called "khopa," and the hollow shells, called "gari" or naryel," and which are used for the water holder of a particular kind of "huka."

Some dye stuffs, including indigo and kussumbha or safflower, are brought from Bengal.

The betel nut and pán,* are procured from the nearest places where they grow. A little turmeric may be included among the foods imported, though it scarcely gets beyond Delhi; black pepper and cardamoms are rather largely imported; also attars, especially of sandal wood and "keora," *(Pandanus odoratissimus,)* from Jaipúr; while drugs in considerable variety, catechu and several gums, complete the list.

Besides these, the following may be enumerated among things brought from Hindústán and Central India:—Diamonds, rubies, precious stones, &c., Dakhan silks, brocades, muslins, cotton goods, glass beads, and shoes.

The Naurya merchants, who bring up these commodities, assemble at Hátras between Agra and Allygurh, and thence these goods go on to Delhi and Amritsar.

Benares has ever been a great place of trade and is so at this day. Brocades (kamkháb†), gold woven scarves (dopatta), and silks are brought from this city to the Punjab; together with a kind of yellow silk dhoti, called "pitambar," and a dark-blue silk with white spots, called "búnd;" also silk sárís or scarves, exclusively for women's wear, forming both a skirt and a scarf.

Delhi is the market for a variety of products of Hindústán, Bengal, and the North Western Provinces; the drugs to be obtained here are more even than those of Amritsar. Several gums, including "katira" and gum-arabic, are obtained from this city; and among manufactured goods, shoes, jewellery, embroidered and spangled scarves, caps, and shawls are conspicuous.

V.—We now come to consider the imports *viá* Bombay and Calcutta. A very large proportion of these consist of such European articles as find a sale in the country, and they are not difficult to distinguish. There is another class of imports which must not be forgotten—the articles not used by natives but by Europeans in India—provisions, beverages, spirits, teas, candles, soaps, perfumery, and a multitude of articles of vertu.

The goods introduced from Karáchí and Bombay, do not differ very

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* The leaves are taken the utmost care of by the merchants, and are moved every day lest one leaf should touch another decayed one; the decayed parts are carefully clipped away with scissors.

† This word is the original of the familiar "kincob."

much either in their nature or in the localities of their production. The imports find their way by land to the Punjab and also by the Indus route.

We find that the lists (given in several of the recent revenue reports) of articles brought up the Indus, include wheat, barley, rice, molasses, sugar, indigo, tobacco, and hemp, all in rather small quantities; while wool, hides, sulphur, madder, dates, almonds, spices, are brought by this route in considerable quantity. To these we must add a few cocoa-nuts, a large quantity of iron, with some pewter and copper; about 1,21,200 bales of cloth are also included in the list for the year 1862. It is, however, only a limited portion of the articles that comes from Káráchí, for the list would appear to include all merchandize that is taken on board country boats at all stations on the Indus and going up-stream.* We have no precise statements of the value of imports into the Punjab from Bombay or Sindh. It would be perhaps difficult to prepare such, but the kinds of articles are now easily ascertained, and that is more to our present purpose.

Judging from the Report for 1862-63 of the trade of Sindh,† by far the greater part of the merchandize landed at Káráchí is derived from Bombay and the British Isles. The Persian Gulf yields a few articles. The late Captain Bruck's Report on the Persian Gulf,‡ enumerates among articles produced by this trade,—silk, dried fruits, gums, dates, horses, pearls, and spices, to the amount of 60 or 80 lakhs annually. "Cowdas" (cowries), in number 16,52,000, valuing Rs. 1,020, are annually imported; together with some plain and colored cotton goods, drugs, asafœtida, the gums (copal and others), "patch leaves," senna, madder, fishmaws, almonds, and dates (to a very large amount); figs and several other fruits are also mentioned, as well as hides, skins, ivory ware, marble slabs, mother o'pearl and a little perfumery. These, with Rs. 21,700 worth of precious stones, and wool in considerable quantity,§ complete the list of of Persian Gulf articles. The Ports of Cutch bring hardly anything to Káráchí except "karbi" and other grass for forage, and a few other unimportant articles.

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* Punjab Revenue Report for 1862-63. Appendix IV.

† Page 58 of the Report.

‡ Bombay Selections, No. XXIV. 1856.

§ This wool is the Kirmáni wool, and finds its way to Amritsar pretty largely from both Kárách and Bombay. It is one of the staples used in adulterating the "pashm," or genuine shawl wool.

The Calcutta trade to Káráchí is almost a blank, with the exception of the two items, rice and gunny bags. The Madras Presidency yields to it no imports. The trade from the ports of Malabar, Konkán, Mekran, and Sonmeaní is altogether unimportant. A small quantity of African ivory, I may add, is said to reach these ports.

The Bombay imports find their way to the Punjab no doubt to a much larger extent than the Káráchí imports, unless indeed an exception is to be made in favor of articles designed for European use. With regard to imports of this class, I may take the opportunity of observing that an enumeration or description of them would be here out of place, as they do not form a part of the Punjab products to illustrate which is my only aim in thus briefly describing the trade fountains which supply these provinces; but it is no less remarkable to see how some of these European materials have been introduced into many manufactures, which in themselves are purely native:—for instance, how in walking through the Courts of the Exhibition, we noticed an elaborate manuscript copy of some Persian work written on the imported foolscap paper of Europe, or the rich silks of Amritsar dyed with the "*rosaniline*," or magenta dye so much in vogue at home,* or the embroidered saddle-cloths of Lahore, all wrought on crimson velvet from the looms of France; to say nothing of country woven fabrics of which the thread is English,—of hardware, of which the iron was forged at Glasgow or at Manchester, and of books neatly bound by native hands, in cloth, morocco, and calf, prepared in English workshops. The opening of our markets for articles of this description has not only influenced the manufactures of the province itself, but has been felt beyond the confines of Bukhára, to the very boundaries of Western Siberia. The import of Russian velvet has become a thing of the past. Almost the same is true of porcelain, and of satin (one kind of the latter is still imported)—and though Russian iron is no doubt to be found in the Provinces of Bukhára or Afghánistán, it is little that ever crosses our frontier, and certainly none that ever reaches our central cities.

Leaving then the exporting countries of Europe,† which are by far the

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* The people call these dyes "shíshí ka rang," literally "bottle color," because the crystals are imported in little phials.

† In 1862-63 the value of Bombay imports from the United Kingdom was, Rs. 6,92,10,331, of merchandize only (exclusive of treasure and bullion), and if we add to this the total of other European countries, we have the grand total of Rs. 7,17,66,025, of which Rs. 21,42,125 worth comes France.

largest contributors, (supplying nearly two-thirds of the imports from ports not Indian, and nearly half of the aggregate imports from all ports together,)—we find that the imports of Bombay are next in degree of quantity derived from the port of Hongkong, which, together with those other ports of China, sends Rs. 1,20,32,972 in merchandize only. Then follow Ceylon, the Persian Gulf, the Coast of Africa, Aden, the Straits, Malacca, &c., Mauritius, the Arabian Gulf, the Red Sea, with a few others of less importance, these names being quoted here in the order of the magnitude of their trade as exhibited for the year 1862-63.

The principal articles to be met with as imports *viâ* Bombay are first—iron, both in plate, bar and rod; the native ironmongers have peculiar names for the various kinds, which are noticed under the head of "iron ores" in the sequel; next we find sheet-copper, brass, lead, pewter, and zinc (which is imported in flat oblong tablets).

Cotton fabrics of all kinds are imported in immense quantity. The bales consist of white cloths and muslins, of figured muslins,—often in peculiar gaudy patterns such as would find no sale in Europe,—and of chintzes and cotton prints, including the Turkey red-cloth, called "sálú," the art of dyeing which, is said once to have flourished in the very country in which it is now only seen as an imported product.* Many chemical substances and medicinal drugs are obtained here; among them may be mentioned the medicinal gums called jaushír (oppoponax), sundras (Indian copal), lúbán (benzoin), kápúr (camphor), kahruba (amber), mustagi rúmí (mastich), 'ushak (gum ammoniacum), sakbínaj (sagapenum), some spices and tea from Ceylon and China, ivory from coast of Africa, and cochineal.

In this class are included the imports of Calcutta. They are for the most part precisely similar to those of Bombay and Kárâchí. This is a necessary result from the fact that the trading ports of both these places are nearly the same. European goods reach the Punjab both by Bombay and Calcutta, and the distinction seems slight. It is only a few articles that are now peculiarly associated with Bombay, viz., the iron of Europe, and those gems and medicinal substances which are the produce of countries bordering on the Persian Gulf.

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* This does not apply to all India, for instance, Madras. *See* Jury's Report to the Madras Exhibition of 1857, on Dyes.

From Calcutta, are brought precious stones, including sapphires and pearls from Ceylon, diamonds, coffee, spices, cloves, nutmegs, black pepper, the produce of Travankúr, gunny bags and "tát," cotton goods of all kinds, "atlas" or satin, and also velvet; iron is less imported from Calcutta to the Punjab, but with the exception of this and the other articles before alluded to, we have no need to draw out a list of articles from Calcutta as distinct from those of Bombay.

The annexed scheme of Classification has been adhered to in the following pages.

The first volume of the work contains all the Classes included in Section A. A second volume will contain a description of the Manufactures and Fine Arts, occupying Sections B., C. and D.

SECTION A.—RAW PRODUCE.

CLASS I.—PRODUCTS OF MINERAL KINGDOM.

Division I.—Metals.

Sub-class (A)—Metals and Ores,—with illustrations of modes of dressing and smelting, &c., also slags, &c., the result of such smelting processes.

„ (B)—Alloys.

„ (C)—Metals in process of adaptation to finished metal manufactures, such as plates of metal, wires, bars, &c.

Division II.—Mineral substances used in manufactures and for building purposes.

Sub-class (A)—Substances used in manufactures. *I. Miscellaneous; II. Glass making, and III. Pottery.*

„ (B)—Fuels, as coal, anthracite, lignite, &c.

„ (C)—Substances used in construction.— (1) *Stones, marble, and bricks;* (2) *Slates or roofing tiles and stones;* (3) *Cements and plaster, &c.*

Sub-class (D)—Minerals used as implements, *hones, grindstones, millstones, &c.*

„ (E)—Minerals used for decoration or ornamental purposes, such as *gems, agates, serpentine, &c.*

Division III.—Chemical substances used in manufactures.

Sub-class (A)—Mineral acids, &c.

„ (B)—Chemical substances used in arts and trades.

„ (C)—Salts, such as *barilla, sal-ammoniac, saltpetre, rock salt* (with illustrations of the process of preparation).

Division IV.—Chemico-Pharmaceutical substances.

Sub-class (A)—Medicinal substances, including mineral waters.

„ (B)—Rarer substances for the use of scientific chemists.

Division V.—Substances illustrative of the geology of the province.

Sub-class (A)—Fossils.

„ (B)—Samples of rocks, &c.

„ (C)—Soils.

CLASS II.—PRODUCTS OF ANIMAL KINGDOM.

Division I.—Animal substances used as food.

Gelatine, cheese, &c.

Division II.—Animal substances used as medicines.

Division III.—Substances used in manufactures.

Sub-class (A)—{ Skins and feathers. Leather and hides.

„ (B)—Bones, horns, &c.

Sub-class (C)—Animal fats, including wax.

„ (D)—Animal fibres—I. Silk. II. Wools.

„ (E)—Substances for miscellaneous uses.

CLASS III.—PRODUCTS OF THE VEGETABLE KINGDOM USED FOR FOOD.

Division I.—Substances used as food for man or cattle.

Sub-class (A)—Agricultural produce.

1. *Cereals.*
2. *Millets.*
3. *Pulses.*
4. *Miscellaneous grains & seeds used as food.*
5. *Grasses.*
6. *Hops.*

(B)—Miscellaneous products of the soil (other than grains) used as food.

Sub-class (C)—Dried, preserved, or pickle fruits, &c.

„ (D)—Tea.

„ (E)—Intoxicating drugs.

„ (F)—Spices.

„ (G)—Saccharine produce (including honey).

„ (H)—Wines and spirits, and substances used in fermenting them, &c.

Division II.—Substances used in medicine.

Drugs.

CLASS IV.—PRODUCTS OF THE VEGETABLE KINGDOM USED IN MANUFACTURES.

Sub-class (A)—Gums, resins, oleo-resins, &c.

„ (B)—Oils—including compounds obtained from oil, *e. g.*, soap.

1. *Essential and fragrant oils and "attars."*
2. *Burning and esculent oils.*
3. *Soaps.*

„ (C)—Substances used for dyeing, including cloths dyed to illustrate the process,—printed fabrics and blocks for printing—also artists' or other trades' colors, and mordants.

Sub-class (D)—Substances used for tanning.

„ (E)—Fibres.

1. *Cotton.*
2. *Other fibres suitable for weaving.*
3. *Fibrous substances not used for weaving, but for ropes, making paper, &c.*

„ (F)—Woods and timbers.

„ (G)—Charcoal.

SECTION B.—MANUFACTURES.

CLASS V.—COTTON MANUFACTURES.

CLASS VI.—WOOLLEN MANUFACTURES.

Division I.—Manufactures of wool.

Sub-class (A)—Carpets.
" (B)—Other fabrics.

Division II.—Pashmina manufactures.

Sub-class (A)—Loom-wove shawls.
" (B)—Plain pashmina goods; *e. g. pattú and alwán, &c.*

Division III.—Hair manufactures—goats' hair, camels' hair, &c.

CLASS VII.—SILK MANUFACTURES.

Division I.—Silk fabrics from the loom.

Division II.—Miscellaneous silk manufactures.

Tassels, nets, chenille work, sashes, &c., &c.

CLASS VIII.—FIBROUS MANUFACTURES.

Division I.—Fabrics of fibres other than cotton and wool.

Division II.—Paper.

Division III.—Other fibrous manufactures.

Mats, chicks, baskets, hats, &c., &c.

CLASS IX.—ARTICLES OF EMBROIDERY.

Articles embroidered with gold and silver thread, and articles embroidered with silk or thread, including hand embroidered, or "amlikar" shawls, &c.

CLASS X.—ARTICLES OF CLOTHING EXHIBITED AS SUCH.

(Including all ethnographic specimens).

CLASS XI.—LEATHER MANUFACTURES.

CLASS XII.—METALLIC MANUFACTURE.

Division I.—Works in non-precious metals.

Sub-class (A)—Brass and compound metal vessels, &c,
Sub-class (B)—Rough iron and hardware.
" (C)—Cutlery, including swords and daggers of all kinds, exhibited for the sake of the blades.

Division II.—Works in the precious metals.

Sub-class (A)—Works in gold and silver wire, "*mukesh*," "*anchal*," *gold lace, &c., &c.*

" (B)—Fabrics woven with gold and silver, *brocade*, "*kamkhab*," *cloth of gold, &c.*

Sub-class (C)—Vessels and articles of gold and silver for use or ornament.

" (D)—Specimens of plating with gold and silver.

CLASS XIII.—JEWELLERY AND ENAMELLING.

CLASS XIV—ARTICLES OF VERTU FOR USE OR ORNAMENT.

CLASS XV.—MANUFACTURES IN WOOD, USEFUL AND ORNAMENTAL.

Division I.—Furniture.

Division II.—Carved and inlaid wood-work.

Division III.—Turned and lacquered wood-work.

CLASS XVI.—IVORY MANUFACTURES.

CLASS XVII.—PAPIER-MACHE WORK.

CLASS XVIII.—PORCELAIN AND POTTERY, INCLUDING GLAZED TILES, &c.

Division I.—Glazed pottery.

Division II.—Un-glazed pottery including ornamented ceramic ware.

CLASS XIX.—GLASS MANUFACTURES.

CLASS XX.—ORNAMENTAL OR FANCY MANUFACTURES, NOT INCLUDED IN THE ABOVE.

SECTION C.—MACHINERY.

CLASS XXI.—PRIME MOVERS, INCLUDING PARTS OF MACHINES AND GEARING.

CLASS XXII.—MACHINES FOR MOVING OR RAISING BODIES.

Division I.—Machines for raising water.

Division II.—Do. for raising weights.

Pile drivers, cranes, &c.

Division III.—Carriages and vehicles, or models of them.

Division IV.—Railway plant.

Division V.—Models of boats, &c.

CLASS XXIII.—MACHINES FOR WEIGHING AND REGISTERING.

Division I.—Horological instruments.

Division II.—Weighing machines—as scales, &c.

CLASS XXIV.—MATHEMATICAL AND PHILOSOPHICAL INSTRUMENTS.

CLASS XXV.—SURGICAL INSTRUMENTS.

CLASS XXVI.—MUSICAL INSTRUMENTS.

CLASS XXVII.—LOCKS AND SMALL MACHINES FOR VARIOUS PURPOSES.

CLASS XXVIII.—ORDNANCE AND ARMS OF ALL KINDS, EXHIBITED AS SUCH.

CLASS XXIX.—MACHINERY AND IMPLEMENTS USED IN TRADES AND OCCUPATIONS.

Division I.—In manual trades.

Including workmen's tools of all kinds, and machinery used in trades, looms, lathes, &c., &c.

Division II.—In agriculture—including cotton cleaning machinery.

Division III.—In Horticulture.

CLASS XXX.—PHOTOGRAPHIC APPARATUS.

CLASS XXXI.—CONTRIVANCES USED IN ARCHITECTURE AND BUILDING, INCLUDING MODELS OF BRIDGES, CANAL FALLS, BARRACKS, &c., &c., &c.

SECTION D.—FINE ARTS.

CLASS XXXII.—PHOTOGRAPHS.

CLASS XXXIII.—SPECIMENS OF WRITTEN CHARACTERS, INCLUDING ORNAMENTAL AND COPPERPLATE WRITING, &c. WHETHER IN BOOKS OR SEPARATE SHEETS.

CLASS XXXIV.—PAINTING OF ALL KINDS, LANDSCAPE AND PORTRAIT, &c.

CLASS XXXV.—MODELS EXHIBITED AS WORKS OF ART,

(as opposed to Engineering Models, which are included in Section C.)

CLASS XXXVI.—MISCELLANEOUS FINE ARTS, NOT INCLUDED IN THE ABOVE.

It now only remains to add that the illustrative letterpress appended to the names of the specimens has been derived from various sources, partly from the information obtained through district officers; largely also from books and records, published and unpublished, and from enquiries made by the author.

It should here be stated that almost the whole of the 2nd Division of Class III., viz., Drugs, is written by Dr. Burton Brown, who, together with Dr. J. L. Stewart, carefully examined the very large collection of drugs, and determined many previously unknown ones, as well corrected several erroneous botanical identifications which have hitherto passed unchallenged through many editions of such lists as Piddington's, O'Shaughnessy's and Honiberger's.

The illustrations are mostly executed from photographs taken at the time by Messrs. Howard and Bourne, with a few by Capt. Mercer. The botanical illustrations are from original drawings.

SECTION A.—RAW PRODUCE.

CLASS I.—PRODUCTS OF MINERAL KINGDOM.

Division I.—Metals.

SUB-CLASS (A). METALS AND ORES.

IRON.

The iron ores of the Punjab are produced along its north-eastern mountain frontier, as well as in the lower hills of the Sulaimaní and Wazírí ranges, and those to the south-east of the Bunnoo district, and to some extent in the Salt range. On the other side of the province, in the hilly portions of Gurgaon district, iron is found, and although the hills in the Delhi district exhibit no specimens of iron ore as such, there is in them a ferruginous rock, samples of which have been forwarded; and the Máhrúli hill, which yields iron ore, is one of that group of outliers that forms a continuation as it were of the Aravalli range, and properly within the Delhi district.

Along the Himaláyan frontier, the principal places of production are the Hill States of the Simla district (Júbal, Dhámi, Bishahr, and Rámpúr). Again at Suket and Mandi, iron is largely produced; and the mines at Kot Khai, Fatihpúr, and Bhír Bangál of Kangra are famous. Pursuing the line of Hill States, the iron of the Chamba hills next demands notice, and the next division up to the Hazara district is included in the territories of H. H. the Maháraja of Kashmír. In these territories the best iron is found at Reyásí in Jammú, while the iron found at Soñf and Kutyár in Kashmír Proper, is not so good. Iron of good quality, but inferior to that of Reyásí occurs in Pûnch, the territory of Raja Motí Singh, feudatory of Kashmír. Reverting once more to British territory, we find iron ore at Bakot in the Hazara district. Next to this, in the hills due north of Peshawur, is the source of the Bajaur iron, which is of fine quality, and is used in the manufacture of the gun barrels of Kuhát and Jammú; and not a little also, it may be presumed, in the formation of steel for the blades of Bukhára and Peshawur.

Nowhere within British territory is indigenous steel procurable, at all events such steel as would be of any use in the finer classes of manufacture; the cutlery of Nizámábád and Gujrát is exclusively manufactured with imported steel, while the inferior kinds are not steel at all but merely polished iron.

The iron ores of the Himaláyan districts are mostly magnetic oxides of singular purity, and exist in a great measure in the form of an iron sand or aggregate of particles of oxide of iron. These are no doubt produced in the detrition or disintegration of schistose and micaceous rock containing particles of metal; this kind of rock or ore is called "pathar dhoñ."

In other places the ore is found as a massive hæmatite, and is sometimes associated with copper. In Suket, and a few other localities, a glistening micaceous iron ore or glistening

hæmatite occurs, but the natives often call it "antimony of Ispahán" (surma Isfahání). In one or two instances it is exhibited as a hydrated peroxide.

The binding power of the hydrated oxide, as well as the quantities of iron that must exist in the upper hills, are well exhibited in the formation of the lower Sub-Himaláyan ranges. I may instance the cuttings for the road to the Dalhousie Sanitarium, where, in the lower hills, the traveller passes huge beds of a formation of nodules and debris of older rock held together by a ferruginous soil, and on the same road there is a small chalybeate spring, the iron of whose water is very sensible to the taste.

Iron exists at Kánigorum in the Wazírí hills; it is found also as a hæmatite in several parts of the Salt range, and in the Chichalli range, on the other side of the river. In a few places near the same ranges, and especially associated with shale, this metal is found in the form of a sulphuret, *i. e.*, iron pyrites, and the beds of the "kasís" and "kahi" (earth containing anhydrous proto-sulphate of iron) are said to result from the decomposition and oxidization of these pyrites. Hydrated peroxide, in the form of ochre, is procured in a number of places in the Punjab, and forms the coloring matter in the "gil-i-zard," or yellow earth, and in the "Múltáni mitti" used by the dyers.

The samples of iron in the collection are as follows :—

GURGAON.

1.—[114.] Iron ore from Firozpúr Hill. DEPUTY COMMISSIONER OF GURGAON.

The box contains specimens of iron pyrites and a piece of micaceous iron ore.

2.—[112.] Block of hæmatite from Máhrowali or Máhrúli hills, bordering on the Delhi district.

3.—[110.] Siliceous iron stone, with a sample of the fused metal and a piece hammered. Firozpúr.

4.—[113]. A fused mass of slag, rich in metal. Fázilpúr.

The following account has been received from the Deputy Commissioner of Gurgaon: "The hill from which the iron is obtained in Firozpúr is known generally by the name "Jharkah," and the iron mines in it are called "búrá" mines, in which by digging to a depth of 6 feet, pieces of a red and slightly glistening hæmatite are obtained, called "búrá." From this ore iron is obtained. In digging for the ore, the miners first come upon a quantity of red earth and soft stone discoloured by iron, which is used to make roads with; below this the hæmatite is found. The ore is first pounded with stones into small fragments, and then taken to the smelting furnace, which is called "nándri." This furnace is of a round conical shape, narrow at the top and wide at the base, and about 9 feet high; into it is put 13 maunds of the ore (this quantity of ore is called a "gán") and 12 maunds of charcoal,—some of it above and some below the crushed ore. Each furnace is fitted with two pairs of bellows, which are worked to supply a blast of air to the fire during eighteen hours continuously,—the melted iron falls to the bottom. Thirteen maunds (= 1 gán) of ore yield 3 maunds of metallic iron,—this is taken out and repeatedly heated and hammered till it becomes pure, when about 1½ maunds of the unmixed metal remain; in thus bringing the iron to its pure state ("lohá pakká"), 5 maunds of charcoal are required besides the 12 consumed in the smelting furnace. Thus to completely work 13 maunds of ore, 17 maunds of charcoal are required, at a cost of Rs. 8-8, (at 2 maunds per rupee,) the total cost of the process is Rs. 10-10, thus :—

	R.	A.	P.
Charcoal, 17 maunds, ...	8	8	0
Wages of workmen at the smelting furnance, ...	0	10	0
Wages of workmen at the bellows and those who hammer out the iron, ...	0	12	0
Wages of workmen who work the metallic iron by repeatedly heating it, &c., ...	0	12	0
Total, Rs., ..	10	10	0

Pucka iron (*i. e.*, after being hammered) sells at Rs. 5 a maund, but iron is not now made at this place.

MANDI.

5.—[215-16-17]. Magnetic oxide, or

iron sand; pig iron and vessel of iron, from the Mandi mines. RAJAH OF MANDI.

In the Mandi territory there are six villages at which iron is smelted; but of the six, two only could supply a sufficient quantity of magnetic oxide of iron for a work of importance, by following the usual system of pounding the mineral, to extract the grains of iron. Regarding the others the mineral appears too poor to offer any advantage. The natives of the two principal iron villages, Kuranee-ka-hutee and Tanagui, draw the mineral from the two opposite sides of the same mountain.

The schist that furnishes the magnetic oxide of iron, varies much as to the quantity of grains of iron it contains, but the oxide seldom exceeds thirty per cent., nor falls below a minimum of from twelve to ten per cent.* The average may thus be stated at about twenty per cent.

The natives follow the same system of working, as has been already described, and the iron produced by this rough industry is paid for by the Raja, at the rate of one rupee per pucka maund. The natives only work these mines, so lucrative to their master, and so unproductive to themselves, when their presence is not required for the cultivation of their fields.

SIMLA HILL STATES.

6.—[174]. Iron ore. Júbal, Simla. RANA OF JUBAL.

7.—[281]. Iron ore from Dhámi. RANA OF DHAMI.

8.—[185]. Iron ore from Bishahr. RANA OF BISHAHR.

9.—[195]. Iron ore from Rámpúr (Bishahr). M. TER ARRATOON.

10 and 11.—[359-60]. Samples of hammered Rámpúr iron. M. TER ARRATOON.

Most of these iron ores occur as iron sands, the grains of which are washed out of the schistose matrix in which they are enclosed. The nature of these ores is well described by MR. MARCADIEU in the following extract †:—

"Passing from the Kot Khai district to Júbal you arrive at Cheel, at about eight miles from Degwarí Júbar and in the possession of the Raja of Rámpúr. Near this village is situated a ferruginous mountain, composed of talcy schists, similar in every point to the mineral of the mountains of the Kot Khai district (*q. v.*) Ten small smelting furnaces work irregularly for the Raja's profit, and produce small quantities of iron, mostly consumed in the Raja's territories. I found that the specimens (without picking them) yielded from fifteen to thirty-seven per cent. of magnetic oxide of iron. Two hours journey beyond Cheel brings you into the possessions of the Rana of Júbal. The iron in these territories is found in three mountains, Jáchali, Panátí, and Paraunti. From Dehra, the residence of the Vana, on the Kot Khai road, at a distance of from five to six miles, are situated,—on the right Jáchali, on the left Paraunti, and on the opposite slope of Jáchali,—Panátí. From 20 to 25 smelting furnaces are worked at distant intervals, but these iron works are becoming profitless for want of combustible material. The proportions of magnetic oxide contained in the talc schists are as follows :—

Jáchali,	from	19 to 33 per cent.
Panátí,	"	17 to 22 " "
Paraunti,	"	20 to 25 " "

12.—[195-96]. Iron ore and crude iron resulting, from the Kot Khai mines, Simla. THE RANA OF KOT KHAI.

The Kot Khai mines are situated on two different mountains close to each other.

The first, near the village of Trola, at about six miles N. E. of Kot Khai, called Moltann.

The second, is called Túmbaran, and is situated at the foot of the village of Degwarí Júbal.

At Moltann there are three extensive subterranean galleries, from one of which the natives draw their mineral, whenever they can procure charcoal for the fabrication of a small quantity of iron. Though the schists of the surface are ferruginous, they are less so than those extracted from the interior of the galleries. These have the advantage of being of a much softer composition, and are more easily reduced to powder. This is owing to their being permanently exposed to the damp, which hastens their disintegregation. The ores from Moltann, yielded from 19 to 33 per cent. of magnetic oxide of iron. Those of Túmbaran, placed in the same conditions, yielded from 28 to 47 per cent. We must not from this difference, too hastily decide that the Túmbaran mine is richer than the other. A disproportion of this kind is often met with and is caused by the variableness of the specimens. The uniformity of the iron mines from Kangra to Kot Khai within a distance of 150 miles, is so striking that they may be classed together as one kind.

* These quantities are given on the authority of MR. MARCADIEU.

† Report on the Ferruginous Resources of the Hills around Dharmsala. Punjab Selections, vol. vi., No. xvii.

KANGRA.

Magnetic oxide of iron occurs in octahedral crystals, embedded, generally speaking, in an extremely friable mica schist throughout most of the spurs from the Snowy range to the East and North East of the Kangra district. It is likewise found in the beds of several of the streams, *e. g.*, the Menoni and Bán Gunga, which cross the Kangra district from the Snowy range. This ore is the same as that of the well known Dannemora mines of Sweden, and is worked as there, at its outcrop in open quarries. It is one of the most valuable ores of iron, being readily reduced in contact with charcoal, in furnaces of the simplest description, and yielding the best quality of iron.

The iron of these hills is preferred by the people for all purposes for which peculiar strength and tenacity are requisite, but in order to compete with English iron for ordinary purposes, any where out of the immediate neighbourhood of the mines, it must be manufactured on a more economical system. The ore is available in any quantity; water power likewise is practically unlimited in the immediate vicinity of most of the mines, and under a proper system of forest conservancy, there will be no need to apprehend a failure of fuel.

The obstacles to be contended in attempting to extend the manufacture, are the remoteness of the mines from the markets, the distance by which the fuel is in some instances separated from the mines, the imperfect means of communication, the reckless destruction of the forests without any measures being adopted for their renewal, the extravagant waste of wood in the manufacture of charcoal and of ore in the smelting and refining, owing to the rudeness of the furnaces and other appliances; and finally, the limited amount of labor available in these desolate regions, and the drunkenness and want of steadiness of the "Dhogrees," the only labourers available for this work; to meet these difficulties new roads have been constructed and others are under consideration; measures are being adopted for the conservation and renewal of the forests, and the expediency of introducing crushing machines and "*catalan*" furnaces has been debated. It seems clear, however, that any machinery adopted must be of the very simplest and least expensive description.

The idea, once suggested, of a grand central crushing and smelting house, to which the ore from all the mines would be carried, is obviously, from the very great distances to be traversed, out of the question. The ore must be reduced at all events to the form of crude iron at the mouth of the mine.

13.—[211-12-13-14]. Series of irons from Bhír Bangál mines, Kangra, consisting of—

a. Magnetic iron ore, in form of iron sand.

b. Crude iron, smelted.

c. Iron, once refined.

d. Iron, twice refined.

"I ascertained," says MR. MARCADIEU, "that each of the furnaces turned out, on an average, 4 maunds of pucka iron, monthly, making an allowance for loss of time, we will suppose that 100 furnaces are worked daily, they would yield monthly 400 maunds of iron or 32,000 pounds, which is purchased by the contractor at two different prices, according to the quality of the iron. He pays for the first quality Rs. 1-14-0, and the second quality, Rs. 0-15-0, which amount is partly paid in money, partly in grain."

In 1858, Kangra iron was sent home to England. The samples consisted of irons from Bhír Bangál. from Kúlú and Mandi.

The iron sent has been tested at the Atlas Works of Messrs. Sharp Stewart & Co., Manchester, and by Messrs. Lloyd, Forster & Co., of Wednesbury. At the former manufactory, while the best English iron yielded at a pressure of about 56,000 lbs. on the square inch, the Kangra iron in the state in which it was sent (it had been forged into 5 feet bars at Madhopúr) required a force of 61,300 lbs. per square inch to break it, while the same iron hammered at Manchester sustained a pressure of 71,800 lbs. per square inch before it gave way. The above results must be deemed highly satisfactory, and clearly indicative of the value of the iron. Messrs. Lloyd & Co., described the metal as of pure charcoal manufacture, quite equal to any of the usual metals of that description imported into England. The particulars of the trials to which the iron was submitted are given in the following statement :—

	Kind of Iron.	Section.	Sectional Diminution. In width.	Sectional Diminution. In thickness.	Greatest extension.	Breaking weight in lbs.	Equal to lbs. per square inch.
N.B.—S = Sharp & Stewart's best hammered scrap iron.	S	1 inch by ½ inch bore,	⅛	$\frac{3}{32}$	$\frac{9}{16}$	27,552	65,104
C = Do. do. charcoal iron.	S	Do.	⅛	$\frac{1}{16}$	$\frac{9}{16}$	28,056	56,112
P = Punjab iron, as it arrived.	S	Do.	⅛	⅛	$\frac{9}{16}$ full	29,184	58,368
P H = Punjab iron hammered at Manchester.							
			Average,	...	... ...	28,233	56,466
	C	1 inch by ½	$\frac{3}{16}$	$\frac{1}{16}$	$\frac{9}{16}$ bore	29,316	58,632
	C	Do.	¼	⅛	$\frac{9}{16}$	28,056	56,112
	C	Do.	$\frac{3}{16}$	⅛	$\frac{9}{16}$	27,636	55,272
			Average,	...	... ...	28,336	56,672
	P	$\frac{13}{16}$ inch by ⅝	8	$\frac{1}{16}$	½ bore	29,120	58,240
	P	Do.	$\frac{1}{32}$	...	½	30,688	61,376
	P	Do.	$\frac{1}{16}$	$\frac{1}{16}$	½	32,144	64,288
			Average,	...	... ...	30,650	61,300
	P H	1 inch by ½	$\frac{1}{16}$	$\frac{1}{32}$	½	36,064	72,128
	P H	Do.	$\frac{3}{32}$	$\frac{1}{16}$	½	34,328	68,656
	P H	Do.	⅛	$\frac{1}{16}$	½ full	37,352	74,704
			Average,	...	... ...	35,913	71,826

(Signed) SHARP, STEWART, & Co.

All the irons had the fibre lengthwise, and were annealed at the Atlas Works.

Messrs. Sharp Stewart & Co., consider the iron to be similar in quality to Yorkshire iron, and they offer the following information as to the shape in which they think it should be imported from the Punjab, and the prices it would probably fetch :—

Shape in which it should be exported.	Probable price per ton.	Shape in which it should be exported.	Probable price per ton.
Round bars, 1 to 2¼ inches in diameter.	£17.	Angle iron, from 2 to 3½ inches and ¼ to ⅜ in thickness.	£19.
Plates, from ¼ inch to ⅜ inch thick.	£21, which increases in proportion to weight of plate; the sizes of plate being according to requirements of the user.	Axles, according to specification of purchaser.	About £18.

The sample of iron cost 5 Rs. a maund = 140 Rs. a ton at Kangra. But this is probably too high a rate, and it could be produced for less, otherwise the rates above quoted would not be remunerative.

14.—[218]. Magnetic oxide of iron. LOCAL EXHIBITION COMMITTEE, KANGRA.

15.—[219-20-21]. Magnetic oxides, in form of iron sands, from the Menoni river between Kangra and Bán Gunga river, and from Suket.

16.—[222]. Bar of iron, from Suket. RAJA OF SUKET.

17.—[237]. Oxide of iron, glistening hæmatite. Suket. RAJA OF SUKET.

This is marked on the box as "supposed to be antimony," it resembles the mineral sold as *surma Isfaháni* (Ispahán antimony) by the native druggists.

18.—[223-230]. Series from the Fatihpúr mines at Suráj, Kangra, and consisting of three samples of the rock around the Fatihpúr mine. LOCAL EXHIBITION COMMITTEE.

[224]. Is a rock called "chinohar," a brown micaceous schist, the mica in very small particles gives the stone a peculiar grey silvery lustre.

[225]. Another specimen called "nalohur." This is a grey mica schist.

[226]. A very fine-grained mica schist of a greyish brown colour called "chappar."

[228]. Rock called "bahor," is a micaceous schist with occasional veins of quartz.

The ores are as follows:—

(*a.*) Magnetic iron ore, in form of iron sand.

(*b.*) Massive ore, "pathar dháo."*

(*c.*) A schistose rock containing fragments of iron; when this rock is disintegrated, the particles of iron from the iron sand of the preceding samples.

(*d.*) Iron, obtained from ditto.

A sample of this iron was exhibited from the Lahore museum under the name of "loha chhichar," and of the same iron hammered, but called "loha kut." An anvil, made of hill iron, a pig of superior iron, and a mass of fused metal mixed up with the charcoal, used in smelting, completed the Museum series.

(*e.*) "Manohar," a slag from the furnaces.

* Indifferently written "dhon."

19.—[231-14]. Series from the Kot Kandi mines. Kúlú. LOCAL EXHIBITION COMMITTEE.

(*a.*) Iron sand.

(*b.*) Hæmatite or specular iron ore. This is very like in appearance to micaceous iron ore.

(*c.*) Crude iron, obtained from the ore.

(*d.*) Slag, the result of fusion.

At the Kumaon mines, four miles east of Pachind pass, the ore lies in thin layers and streaks in a dark micaceous sandstone. The stone is so soft that it is pounded by hand with small round boulder stones. It is then washed in wooden platters, and the sand is poured off with the water, leaving the ore in the shape of coarse black heavy grains at the bottom. One seer of this ore yields half a seer of iron. The metal is considered good, and is sold on the spot at Rs. 2½ a pucka maund, or Rs. 1 a kucha maund of 12 seers, which is cheaper than it was in Moorcroft's time, when the price was Rs. 3½ per pucka maund.*

20.—[234]. Charcoal, used in smelting at Kangra and Kúlú. LOCAL COMMITTEE.

The charcoal is made from the chíl (*Pinus longifolia*). Oak charcoal is not found by the iron workers to answer.

21.—[266]. Iron pyrites, from Kangra.

22.—[239]. Iron pyrites in quartz, from Manikaran of Kúlú. LOCAL COMMITTEE.

This is erroneously called by natives silver ore. It appears to be the mineral, which they informed MR. MARCADIEU, had been worked in the Sikh times as a silver ore. MR. MARCADIEU states, that it consists of crystals of the sulphurets of iron and lead in quartz, and that on analysis it does not contain a trace of silver.†

AMRITSAR SERIES.

23—[329]. Crude iron, of variety, called "guléri."

This is imported from Gwalior; hence its name.

24.—[330]. Mandi iron.

* Cuningham's Trip to Kúlú and Lahaul, in Asiatic Society's Proceedings, March 1848.

† Kangra Local Committee.

LAHORE SERIES.

25.—[346-8]. Iron ores from Chamba. LAHORE MUSEUM.

One specimen is hæmatite.

26.—[347]. Clay nodule, containing iron. LAHORE MUSEUM.

27.—[350]. Hæmatite, Sangli hills, containing copper in small quantity. LAHORE MUSEUM.

The following are the kinds of iron to be met with in the Lahore bazars.

28.—[365-8]. 2nd class steel, "asbát," used for coarse cheap cutlery purposes.

29.—Iron, variety "khéri," used for agricultural and other implements.

Do. variety "barki."

Do. variety "guléri," comes from Gwalior in Hindústán, it is a tenacious metal and used for wire drawing, gun barrels, &c.

Besides these varieties the following kinds are met with in the shops of the "lohtis" or iron sellers, who are the persons who buy wholesale from the Nowrias and other merchants and then sell by retail to the blacksmiths or "lohars." Of Indian iron, the varieties are—the "khéri," noted above; this is said to be brought from Hindústán, it is an iron of unpromising appearance, but exhibits on being forged its superior quality; it is much employed for carpenters' tools, adzes, &c., and occasionally for swords. It values about 4 seers per rupee; its probable origin is the Jaipúr territory.

"Faulád" or steel, used to be imported from Hindústán for the manufacture of armour, shields, &c., at the present day when the manufacture of such armour is not carried on, the import has ceased, the steel used to be brought in "chaktis" or circular disks, about ¾ of an inch thick. "Guléri" iron, which is sold in pigs, and values Rs. 6-12 per maund, is a tenacious iron used also in wire drawing. The imported Indian irons are brought up by Naurias to Hátras between Allygurh "and Agra, and from thence taken to Amritsar, which is the Punjab mart. Of Punjab iron, the "bajauri," from Bajaur, north of Peshawur, is not much exported to the Central Plain districts, though it was formerly for the purposes of gun making. Bajauri iron is still largely used at Kuhát in the remarkable process of their gun barrel making, and is used also at Kálábágh and other places. The guns and cutlery made at Nizámábád, in the Gujranwala district, are of "guléri" iron or of "asbát." European steel is also employed for cutlery.

Barki iron is brought down from Suket and the Mandi mines, it values Rs. 6-12 to 7 a maund, and finds its way on backs of mules and donkeys to Dínanagar whence it comes to Amritsar: it is probable that other irons of the Kangra district mines are similary imported under this name. Attempts have been made by individual traders to bring down the iron of the Chamba territory, but the cost of carriage is too great to render it profitable, and it is seldom imported.

The other irons of the bazar are European, and brought from Bombay; the varieties are—

The "gláspatti," an iron sold in long flat bars; it is used for making tires of wheels, &c. Value Rs. 6-12 a maund.

"Gol sínk," thick pieces of iron, value Rs. 7 a maund; and also "Gol kandla," a similar iron, but in thinner bars; value Rs. 8 a maund.

"Chádar," or sheet iron, value at Rs. 8 a maund, is employed in making "tavas," large iron cauldrons, &c.

"Chakor sínk" and "chakor kandla,"—are varieties of iron, imported in long rods, 15 feet or so, about 3 inches broad and ½ thick,—this sells at Rs. 9 a maund. When the rods are thin, it is called "chakor kandla," and fetches Rs. 7 per maund.

These bars are stamped with a European trademark when of the first quality; these are the most approved, and are called "sacha chakor," (genuine "chakor") and fetch Rs. 9-8. If these bars are only the same in shape without the stamp, they fetch Rs. 9 and Rs. 7, as above-mentioned.

Another variety is "asbát," a hard but brittle kind of steel, selling at 3½ seers per rupee,; it is imported in bars, and is used for tools on account of its hardness.

A kind of iron is sold in the bazars called "fálli," being sold in pieces of a fusi-form shape, tapering at each end. This is probably a hill iron. I noticed this form of iron in all the shops of ironmongers of Núrpúr, in the Kangra district.

It is a remarkable fact, that iron smelted at a low temperature does not form into cast, but into an impure wrought-iron. In our ordinary smelting process adopted at home, the metal fused at a high temperature falls liquid to the bottom of the furnace, and thence, when the furnace is tapped, rushes forth into a series of shallow moulds formed in sand. The pigs thus formed are unmalleable brittle cast-iron, and require the action [except in the Bessemer process, which is different] of the "reverberatory" and "puddling" furnaces, before bars of malleable iron are procured, but in the native smelting process the temperature employed is low. At the end of two days

the metal, which is softened rather than liquefied, drops through the charcoal and slags to the bottom, and is raked out; it is simply reduced to the form of wrought malleable iron by being repeatedly heated and hammered till the fragments of charcoal and other impurities are expelled. This remarkable fact that the effect produced on the metal is different, according as it is smelted at a greater or less temperature, accounts for the existence of wrought-iron among the ancient Greeks and Romans, to whom of course the modern processes of the puddling furnace, &c., were unknown.

The art of forging or welding together several kinds of iron is noticed elsewhere; the principal variety of iron so forged is the sakela, consisting of khéri, asbát and faulád, hammered together; it is used for sword blades.

DERA ISMAIL KHAN.

30.—[523]. Iron ore. Sulaimaní hills. Local Exhibition Committee.

31.—[529]. Iron, from Wazírí hills.

The Wazírí hill iron, from Kanigorum, in the Dera Ismail Khán, supplies Dera Ghází Khán, to the extent of some 2,000 maunds. It is described as a very rough iron,—some of it is re-smelted at Kálábágh.

The iron mines in the Wazírí territory are in the hill called Kuh-i-Mas'úd, near Makbín and Bobra; there the metal is found as a blackish and slightly lustrous ore; it is dug out and crushed. The furnace is made like a lime-kiln beneath the shelter of a round-roofed shed called "mundáo." The furnace is charged with two parts charcoal and one of crushed ore; this being ignited is urged by bellows. When the ore is melted they insert an iron tool into the furnace and rake away the dross and slag which allows the melted metal to fall to the bottom. This iron is called "khám mátri," it sells at 20 seers per rupee; this iron again refined by melting is called locally "kára kai" and "pápoli," and sells at 10 seers per rupee. The proprietary right in the mines is defined only by mutual agreement; it is said that Rs. 25,000 worth of iron from the mine is sold per annum, but this is probably over-estimated; Rs. 10,000 would be nearly the mark. The inhabitants of Makbín and Shaikh 'Edli make vessels and plates of the iron and trade with them. The Firmáli tribe in the Wazírí Iláka carry these vessels into Kábul and Ghazní and sell them.

32.—[530]. Iron from Bajaur.

Brought down from the hills north of Peshawur. (See No. 39).

33.—[556]. Iron ore, found in the hills 25 or 30 miles south-east of Bunnoo.

Found in abundance, is in great demand at Kálábágh for nails, &c., in boat building, and for the manufacture of cooking utensils. The ore is abundant.

These hills are a portion or continuation of the Salt range group, and so these specimens may be said to represent the iron of that range, which is found in various places, but not much worked; the ore occurs as red peroxide and hæmatite, the red tint of many of the formations is owing to this, and it is stated, that in some parts of the Salt range, the rocks are so full of magnetic iron ore that they destroy the indications of the magnetic compass in the vicinity.

Dr. Henderson has recently produced some iron of most excellent quality from a blackish hæmatite ore, found in abundance in a large isolated hill of permian formation, called Kirána. It is just within the Jhilam district. Galena or lead ore is abundant in the same locality.

34.—[555]. Sample of rough iron, value Rs. 5 per maund.

35.—[954]. "Sonmakki" or iron pyrites in crystals. Kálábágh.

SHAHPUR.

36.—[911]. Iron pyrites, from Mukrach. Mr. Chill.

JHILAM.

37.—[462]. Iron pyrites in round nodules of crystals, Karúli mountain. Sadik Shah. (Erroneously called "impure copper" in the original list.)

The name "sonmakki," theoretically is copper pyrites, and "rupamakki," iron pyrites, but the two are not usually distinguished by natives.

PESHAWUR.

38.—[560] Fused iron, "aowah ospanah." Bajaur to the north of Peshawur; value Rs. 7 a maund. Local Committee of Peshawur.

39.—[569]. Hammered iron, "pukkah ospanah," from Bajaur; value Rs. 16 a maund. These samples do not represent the *best* produce of Bajaur.

Bajaur produces iron of good quality. At a place called Burowl, at foot of a range of hills subject to Ghazzan Khán of Dhir, it is said to be found in greatest quantity. The ore is not obtained by mining, but in a pulverized state, mixed up with black earth washed down by hill-streams, which is collected by the people and exported to Peshawur and other neighbouring markets, where it is sold after it has undergone the process of smelting. This process consists of mixing the black earth containing the ore with coal, and burning them together until the iron becomes a consistent mass, from which pieces are disposed of as may be necessary. The value of the ore mixed up with earth, as it leaves its native hills, has not been accurately ascertained; but it is believed the cost in its pristine state is very small. The carriage hire on donkeys and mules to Peshawur and other markets adds to it, and after smelting it sells, according to its quality, at Rs. 3 to 6 per maund.

HAZARA.

40.—[589]. Iron ore (red hæmatite), "matti loha." Bakōt. Local Committee of Hazara.

KASHMIR.

41.—[599]. Siliceous iron stone, from Reyúsí, 20 miles above Jammú. H. H. The Maharaja.

42.—[612]. "Sangi chamak." Massive magnetic ore, brought from Yarkand *viâ* Lahaul.

COPPER.

GURGAON.

43.—[105]. Copper ore with iron, (copper pyrites), from Singhána in Ferozpúr Tahsil. Deputy Commissioner of Gurgaon.

With regard to No. 43 (105), in the time of Ahmad Baksh Khán Jaghirdar, some copper ore was found in the hill called Gháta Shamsábád, but it is not worked.

HISSAR.

44.—[155]. Copper ore, "támbe ka pattar," from Lagháná, Bhagúl, Ketari, and Buhai. Local Exhibition Committee.

The ore is obtained by mining the hill side; the work is carried on only by day, and then with the aid of lamp light. Occasionally a rush of water causes the work to be stopped, and as there is no mechanical contrivance for controlling the flood, not unfrequently the particular spot has to be abandoned altogether. The ore obtained from the mine is broken into pieces and smelted sufficiently to make it cake; on this, wood and the common "úpla" (dry cow-dung) of the country are heaped, and the mass set on fire. The process of extracting the metal is similar to that of burning lime; the copper, contained in the pulverized and caked mass, percolates through the calcined refuse, and finally forms irregular shaped fragments at the base.* These fragments are cut up into pieces like the sample following.

45.—[156]. Copper obtained from the ore, No. 44. It is in little dice, or melted drops of about ½ an inch square.

The smelting of copper is barely remunerative on account of the utter absence of all mechanical appliances. The miners pay a royalty of one-sixth of the gross produce to the Khetari Rájah, feudatory of Jaipúr.

JHILAM.

46.—[462]. Copper pyrites.

This is not copper, but iron.

The terms "sona-makki" and "rúpa-makki," though, properly speaking, indicating copper and iron respectively, are, in practice, synonyms.

The Salt range contains copper, in the form of concretionary nodules in some of the calcareous and shale strata of the Devonian series; the nodules give by their decomposition a green colour to the sandy clay: the yield of metal, is from 12 to 20 per cent, but the quantity of the ore is inconsiderable; it exists as nodules, varying in size from mere grains up to as large as a walnut.

KANGRA.

47.—[240]. Copper ore, Pelang, Kúlú.

This box contains two specimens; one a quartz, containing a little copper pyrites and some silicate of copper, and the other, marked as from Manikaran, is a hard reddish grit, which has no appearance or probability of containing copper. Mr. Marcadieu noticed this ore, and thought it of no importance commercially, unless it indicated the propinquity of other richer ore.

* Hissar Local Committee.

48.—[296]. Quartz with blue carbonate of copper. Spiti. P. EGERTON, ESQ.

KASHMIR.

49.—[ ]. Copper glance. Rondu, 16 marches beyond Kashmír. Since the Exhibition closed, a very interesting specimen of copper, both as a copper glance, or sulphide, and in the form of pyrites, has been sent by F. H. COOPER, ESQ., C.B., Resident. A sample of fused copper of good quality accompanies it.

TIN.

50.—[7·971]. Specimen of melted tin in a disk. Lahore bazar. MISR MEG RAJ.

The metal is imported: it is principally used for making bright toys and imitation trinkets, as well as to tin copper vessels; it is beaten out into leaf, and used by the artist also for a silver paint; it is rather expensive as a metal. The value of the network disk of tin strips, which is the form exhibited, is Rs. 2-12.

ANTIMONY.

This metal occurs in various parts of the province as a black ore of antimony. In composition it is a ter-sulphide, and called "surma." It is fused by heating in a covered pot; the metal melts easily and runs off; the ore usually contains lead, and sometimes silver, iron, copper, and arsenic. The use of this metal, as an alloy or pure metal for scientific purposes is unknown in this province; but the ter-sulphide is reduced to a fine powder, and sold by druggists as a cosmetic for the eyes, in which case, it is supposed to act as a tonic to the nerves of the eye and strengthens the sight. This surma is in use in all Eastern countries.* It is constantly confused by natives with galena or sulphuret of lead, as both yield, when ground up, a dark coloured powder. The natives have also applied to another substance, Iceland spar (carbonate of lime), the name "surma safaid," literally, "white antimony," though the substance has no analogy with the ter-sulphide except in the form and fracture of the lumps in which both are sold by the druggists. Native doctors however prescribe the "surma safaid" for the eyes, just like real antimony, and this keeps up the misapprehension.

The ore is much imported from Kandahâr, but is produced in great abundance in the Himaláyan range, where it was noticed by Captain Hay at Spiti. "Surma" also is said to occur in the Salt range, but there is no sample of antimony sent from these mountains—all the specimens sent under the name of antimony are really *galena*, which natives confuse with surma, such samples are sent from Jhilam, Karangli, the Watli hills, and from Shahpúr at Khagúla; but as these metals are not unfrequently associated, it may be true that both are to be met with. Antimony also is found at Kúlú and at Bajaur, in the hills north of Peshawur. From Baila, in the province of Lus, to north of Khelat, antimony is imported to Shikarpúr in Sindh, to the extent of 15½ maunds a year. By far the greater part of the antimony (really galena) of the druggists is imported from Kábul and Bukhára.

LAHORE.

51.—[369-72] (*a*). Three samples of good antimony ore, (LAHORE MUSEUM,) probably from countries near Kábul, but no name is recorded.

(*b*). "Surma pahári."—Antimony from hills in the Punjab territory; price 12 annas per seer. Lahore bazar.

(*c*). "Surma Kandahári," from Kandahár, as its name imports, is a superior kind; value, Rs. 1-8 a seer. Lahore bazar. A sample exhibited and purchased from the bazar as "surma Kandahári," re-

* The Musulmans have a notion that the finest kind of surma comes from Arabia in the hills of Sinai, &c. The tradition is, that when Moses was on the Mount, he asked that the glory of the Almighty might be shown him; he was answered, that his mortal sight could not bear the glory, but through a chink of the rock a ray of the light was allowed to fall on him, and that the rock on which the ray fell became melted into antimony.

markable for its pure and brilliant appearance, proved to be sulphuret of lead.*

(*d*) [374]. "Surmi," an inferior hard kind of ore. Surmi is sometimes said to be sulphide of zinc, but this sample is not so.

KANGRA.

52.—[279]. Sulphuret of antimony, "rindi dowa" (meaning lead ore in Thibetan), from Lahaul. R. ELWES, ESQ.

This is found on the Chandra valley above Koksar.

53.—[236]. Sulphuret of antimony, "surmi ka pattar." Jagatsukh, Kúlú.

This is a good ore.

54.—[288 & 297]. Two samples of sulphuret of antimony. Spiti. KANGRA EXHIBITION COMMITTEE.

In one the ore is associated with iron pyrites.

HAZARA.

55.—[590]. Antimony ore, from Bakōt (erroneously called tin ore); it contains no tin, but a little iron; only a small quantity was discovered, and further excavations were made in search but without effect.

PESHAWUR.

56.—[567]. Antimony, "ranjah," from Bajaur. LOCAL COMMITTEE.

This is a very good ore, value Rs. 12 a maund.

SIMLA.

57.—[711]. Antimony, from Sirmúr. RAJAH OF SIRMUR.

DERA GHAZI KHAN.

58.—[929]. Antimony, from the Lower Hills. MUNICIPAL COMMITTEE.

LEAD.

Occurs in various places in the form of a sulphuret or galena, sometimes associated with quartz; it is used by natives indiscriminately for antimony, and is called surma with it, as before remarked.

But a large quantity of sulphuret of lead is brought down from Reyási in the Jammú territory to Amritsar, it is there melted up in pots with iron filings,—the small particles of iron combine with the sulphur, setting free the pure metallic lead.

KANGRA.

59.—[238]. Galena in quartz, from a vein at Kothi Harkandi, at Rúpi, on the Parbatí river, Kúlú. LOCAL EXHIBITION COMMITTEE.

It forms nests in the quartz beds, which rest on the mica schist strata on the left bank of the Parbatí.

LAHORE.

60.—[373]. Galena from Kandahár. Rs. 1-8 a seer.

This sample was bought in the bazar as antimony, "surma."

AMRITSAR.

61.—[333]. Sample of metallic lead as used in the bazar.

KASHMIR.

62.—[615]. Sulphide of lead (surma), from the Jammú hills. H. H. THE MAHARAJA.

JHILAM.

63.—[901-902]. Sulphide of lead, from the Karangli and Watli Hills. LOCAL EXHIBITION COMMITTEE. Value, from 7 tolahs 10 mashes to 10 tolahs for the rupee.

The lead (called antimony) of Karangli occurs in the most inaccessible precipices of the hills. Bowring gives the following account of the method of obtaining it. He says :*—

* All the species of what is called "surma Kandahári," that I have seen, prove to be lead, which is distinguishable to the eye, from the antimony, by its cubic crystallized appearance exhibited in fracture. There is another substance called "surma Ispáhani" (*i. e.*, Ispáhan antimony) of which the sample exhibited proved on analysis to be micaceous glistening iron ore.

* Bowring's Jhelum, Journal of the Asiatic Society. No. 1 of 1850, p. 50.

"The zemindars who search for it, let themselves down the face of the precipice, and pick the mineral out of a hole in which it occurs pierced in the side of the rock. In this perilous adventure, some unfortunates have lost their lives by falling down the cliff,—a height of more than 5,000 feet."

SHAHPUR.

64.—[904]. Sulphide of lead, in small fragments. Khagúla. Mr. Chill.

(Both the above are entered in the original lists as antimony).

These sulphides occur in small cubic crystals in limestone beds within the Karangli hill, and near the Kheura mine.

GOLD.

The metal occurs only in sand, washed down in greater or less abundance by the rivers of the Punjab. There is however no sample obtained from the Rávi. There is also no exhibited specimens of auriferous quartz, nor has any yet been discovered in any of the mountain ranges. There is a mineral sent from Thal Baland Khail in foreign territory near Bunnoo, called "sang-i-zardár," but its containing gold is imaginary. Native silver also does not appear; it is found in minute quantities associated with the ores of lead and antimony, but that is all. Gold-washing is taxed and becomes a source of revenue to the state, though not a very productive one. The revenue report, shows that the produce of the tax was for 1860-61, Rs. 444; in 1861-62, Rs. 530.

AMBALLA.

65.—[168-70]. (*a*) Sand; (*b*) do., washed to remove the first impurities; (*c*) Gold obtained from it. From Karrar, near the Markanda river.

KANGRA.

66.—[235]. Gold-sand and gold obtained from it. Beyás river, near Haripúr. Local Exhibition Committee.

This sample sent has been obtained by numerous washings from several maunds of earth and sand taken from the river bed. The quantity of gold is so minute, that not more than 3 or 4 annas worth is obtained by a day's hard labour at washing.*

67.—[287]. A substance believed to contain gold by the natives, from Spiti. P. Egerton, Esq.

This is a soft red earth, like "gil irmani," there is no appearance or probability of its containing gold.

68.—[279]. Gold from Lahaul. Rev. Mr. Jaeschke.

This is called "gser" (pronounced "ser") in Thibetan. It is obtained from the sand of larger rivers of Lahaul and Zangskar. Most of it is taken to Hindústán and sold, but the profit of goldworks are very small; it takes several months to collect even a tolah; the small grains are worked up into little lumps with the aid of mercury, value, 1 tolah for Rs. 15.

RAWAL PINDI.

69.—[238]. Gold-washings. Attock. Major Sandilands.

70.—[ ]. Bar of pure gold. Weight 35½ tolahs; value, Rs. 655.

JHILAM.

71.—[379]. Gold washed from the river Jhilam. Lahore Museum.

72.—[460]. Gold, from Kas Gabhír. Tehsildar of Tala Ganj.

73.—[461]. Gold, from Kas Soj. Jawala Khatri.

In the tertiary formations of the Salt range, gold is found in the shape of minute scales, and has doubtless been derived from plutonic and metamorphic rocks, the disintegration of which has furnished the material of which the strata of the series are composed.

And in the beds of numerous nullahs which flow through the "meiocene" formations, the sand is washed for gold. It seems to be obtained in the largest quantity towards the Indus, north of the Salt range.

The original beds whence gold is derived have not yet been found. The quartzites and quartzoze mica slate much developed in the Pír Panjál range near the Baramúla pass and other localities, have as yet failed to yield gold.

The process of washing the river sands for gold is as follows:—

When a likely spot in the bed of a nullah is fixed

* Kangra Local Committee.

upon, the superficial mud is scraped off and lower sand taken out with a wooden shovel and carried to the spot where it is to be washed, close at hand. The washing is effected in a long wooden box resembling a small flat-bottomed boat, wide at one end, and narrow at the other, where there is an opening for the escape of the water. The wide end of the cradle or "drún" as it is called, is slightly bent upwards so as to give its flat bottom a gentle inclination towards the fore part. A coarse sieve of reeds is then placed across the wide end of the tray; on this the sand is thrown, and water dashed upon it, till all the finer sand is washed through into the cradle, and the coarse gravel retained on the sieve. By continuing the washing with a gentle stream of water the lighter particles of fine sand are carried down the inclined floor of cradle and escape with the water, while the heavier and auriferous sand assumes the highest level next to the point where the water is applied. In a very short time nothing remains but a thin stratum of black iron sand, in which scales of gold may occasionally be seen to spangle.

By continuing the washing still further, the lighter particles are removed and the auriferous portion concentrated within narrow limits. When the washing in the cradle has been carried as far as is considered safe, the sand is removed by hand into a platter called a "karí," made of sisu or some other hard wood. In this, by a circular motion, it is agitated with water, and thus an additional portion of the black sand is got rid of, and washed away from the inclined sides of the plate by a stream of water skilfully applied. The residue is then rubbed up with a little mercury, which quickly amalgamates with the gold and leaves the black sand. The mercury is then removed from the platter and wrapped in a fragment of cloth, and placed on a bit of live charcoal, the mercury quickly sublimes, leaving the gold entangled only with the ashes of the cloth from which it is freed by rubbing. It is taken next to the goldsmith, who fuses it with borax, and thus it is cleaned. Grains of native platinum are found in the same way in the Indus, and in some places the natives call it "white gold," and despise it exceedingly.

In the gold-washing process just described, two or three individuals earn from 6 to 8 annas a day. It is said that in Hazara grains of gold are sometimes found of such a size as to allow of their being picked out of the sand.

The gold-washings of the Salt range are nearly all in the Jhilam district. In the year 1850, 158 cradles were at work, and they were taxed from Rs. 2 to 5 per "troon;" the total tax amounted to Rs. 525.

The Kardar of Mokhund told Dr. Fleming in 1848, that the production of gold was as follows:—

1844—409 tolahs (tolah = 165 grains.)
1845—272 ditto.
1846—332 ditto.

The gold-washers conceal the amount as much as possible to reduce the tax.*

PESHAWUR.

74.—[566]. Auriferous sand, "torah shigga." River Indus. Local Exhibition Committee.

In both the Indus (above Attock) and the Kábul rivers, auriferous deposits are found, though not extensively. Some of the boatmen, during the cold weather, work as gold-washers in gangs of from five to seven, and collect on an average from 2 to 2¼ tolahs each in the season. The gold sells at Peshawur at Rs. 15 per tolah, so this would yield them about two annas per diem, whilst actually employed. Their apparatus for washing the sand consists only of large wooden trays, six feet in length, and sieves. No tax is taken from them now, but under the Sikhs, one-fourth of the proceeds was paid to the Kardar, whose license was necessary before they plied their trade. In some places a tax was taken of Rs. 2 per tray, and the proprietors of the soil received another rupee. About 150 men may be thus annually employed, and it is not unusual for them to receive advances for the work from the gold purchasers at Peshawur. These deposits indicate the presence of gold in the hills, but the latter are beyond our reach: a mine has been lately discovered near Kandahár, but its value has not yet been fully tested by the Amír. Still the gold-washings of these rivers might be advantageously examined by those who possess the necessary qualifications.†

BUNNOO.

75.—[564]. Gold-dust, "reg-tilá," from the river Indus, where it occurs in small quantities. The value of the produce is probably Rs. 200 a year. Deputy Commissioner of Bunnoo.

HAZARA.

76.—[587-8]. Gold and gold-dust, from the river Indus. Value, Rs. 15 a tolah.

* Fleming's Report on the Salt Range. Select Correspondence of the Punjab Government. No. xxii., p. 348.

† Local Committee.

In the streams where gold-sand is washed, grains of platinum are occasionally found in small quantities; the gold-seekers call the metal "safed sona," and reject it as useless. Platinum has been found in the Tavi river of Jammú territory, and in the Kábal river at Naushera.

Of other rarer metals, bismuth has been obtained in small quantities in Kashmír from the Jammú territory.

SUB-CLASS (B). ALLOYS.

The class of alloys is but poorly represented; the compounded metals known to the natives are all more or less based on copper. The white metals and alloys of bismuth, antimony, and other substances, are quite unknown.

Brass is manufactured in the more important cities, but not in large quantities. The larger vessels, "gágars," "shamadáns," &c., are made of imported brass. The native brass is of different quality as to hardness, according to the proportion of zinc employed. Besides brass, a metal giving a beautiful sonorous ring when struck, and called "phúl" or "khánsi," is made. "Roíñ," a genuine bell metal, is also manufactured. If we add to these a compound called "barth," and another inferior one called "kuth," the list of alloys in common use will be complete. Pewter articles are occasionally to be met with, but the alloy is uncommon. The varieties of alloyed silver, known as "rúpa," are merely silver debased by the addition of copper or zinc, or both.*

LAHORE.

77.—[7954]. Sample of "phúl" or "khánsi," a kind of bell-metal. MISR MEG RAJ.

78.—[7854]. Sample of "barth" metal.

79.—[7954]. Sample of brass as sold in the bazar. MISR MEG RAJ.

AMRITSAR.

80.—[332]. "Khánsi," bell-metal. LOCAL COMMITTEE. Roíñ, is also a kind of bell-metal.

81.—[331]. (*a*) "Pital," brass, with the kutháli, or earthen crucible in which it is melted. LOCAL COMMITTEE.

The crucible is made by beating together flocks of cotton wool and stiff clay till both are thoroughly combined; the whole is then dried; the cotton serves to bind the clay, and answers the same purpose as hair in mortar. The kutháli exhibited is of very small size, such as is used for gold-melting; for brass, ordinarily, a much larger size would be used.

* A mixed metal formed by welding together different metals is not technically an alloy, but approaches so near that a mention of such metals may not be inappropriate.

A metal known as "sakela," is used for the manufacture of swords, &c., consisting of cast-iron, asbát and khéri iron, and faulád or steel welded together. Occasionally, in Jammú, a small quantity of silver and sometimes tin, is beaten into and welded with the finest sword blades for the sake of texture and polish.

SUB-CLASS (C). METALS, IN THE PROGRESS OF ADAPTATION TO FINISHED MANUFACTURES.

The process of wire-drawing in various metals is carried on with considerable success, the gold wire-drawing in particular is very skilfully performed, and with very simple apparatus; the metal to be drawn being guaged as to the size of the wire by a perforated iron plate; the processes of flattening and producing a wave in the wire, for the purpose of making gold thread, tinsel, &c. (kalábátun), are performed with considerable ingenuity with the aid of a fine hammer and a tiny polished iron anvil.

LAHORE.

82.—[7973]. Coils of iron wire, thick and thin. Misr Meg Raj.

Guléri iron is employed for wire-drawing.

83 —[7974]. Coils of brass wire, do.

84.—[7975]. Sample of copper wire.

85.—[7976]. Sample of zinc wire.

86.—[7972]. Case contained a series of specimens of metallic leaf; viz., silver, gold, tinfoil, and brass leaf, or "orsdew."

The silver and gold leaf are used for a variety of ornamental purposes, and silver leaf is much used in adorning festival sweetmeats. The orsdew is a cheap substitute for gold leaf, but is much thicker in substance.

87.—[7955]. Sample of sheet copper Misr Meg Raj.

This is imported, as all copper used for the manufacture of large vessels or fine copper work is. The copper of Hissar, in small fragments or pigs, is also to be had in the bazars.

PATTIALA.

88.—[ ]. Sample of silver wire (fine).

89.—[ ]. Sample of gold and silver leaf.

Division II.—Mineral Substances used in Manufactures and for Building purposes.

SUB-CLASS (A). SUBSTACES USED IN MANUFACTURES.

PLUMBAGO.

THERE are several samples of this mineral which mark paper easily, but scarcely one that would be fit to manufacture lead pencils from. There are several black stones and carbonaceous shales, which are erroneously called graphites or plumbagos; for instance, a specimen from Simla, called graphite, is a sample of some rolled pebbles of a black grauwacke or hard rock of the older formation, which does not make a mark on paper.

KANGRA.

90.—[263]. Mineral supposed to be plumbago, called "kali mitti," from Haripúr. LOCAL EXHIBITION COMMITTEE.

This substance is used in cleaning colored pottery, also in cleaning the hair. It is not a plumbago, but a black clay full of organic matter; which, however, marks paper.

GURGAON.

91.—[106-7]. Plumbagos from Sonah and Bhúndi. DEPUTY COMMISSIONER.

Of these samples one is a shale, which marks paper. The other is a carbonaceous shale.

The box contains little cubic pieces to show its sectility. These mark paper, but are more like a drawing crayon than black lead.

92.—[375]. Mixed shale and plumbago.

93.—[377-88]. Plumbago of a dark shade.

94.—[377]. A dark talcose schist, used as plumbago, giving a deep black mark. LAHORE MUSEUM.

Accompanying these samples there is unfortunately no record of their locality. It is probable that they may have been sent from Gurgaon at the time when the report was made by DR. THOMSON, extracts from which are added. Exhibited along with them was a drawing of a butterfly, bird, and beetle, executed with points of these black leads.

DR. W. J. THOMSON describes the plumbago of Gurgaon as follows :—

While on duty at Sonah a few days ago, I made a cursory geological examination of the hills near the town. The most eastern point of the hill at Sonah is semi-detached from the principal range by a deep gorge. This portion is composed of sandstone much indurated by heat and mixed with eruptive quartzose and gneiss rock near the top. About half way up (100 feet) on the eastern slope of the gorge, where it is nearly precipitous, I found a bed of soft black stone easily friable and soiling the fingers when touched, and brought home some specimens. The bed was from 18 to 24 inches thick, and as far as traced it extended about 30 yards N. and S., and had a dip of nearly 10° to the N. Not having examined the stone minutely till I arrived in Gurgaon next day, I had only a conjecture as to its nature, and the great rarity of plumbago made me doubt its identity till tested; hence I did not examine the vein further from the surface, but as the specimens sent have been long exposed to air and moisture, I conjecture that a plumbago of an equally pure quality and more dense structure will be found further in.

The natives of Sonah were aware of the presence of a soft black stone in the hill, but had no idea of

its nature or use, so it has remained untouched. The specimen sent has a specific gravity of 1937·5, water being 1000. It is unchanged by a red heat in an open fire, and is not acted on by strong nitric acid. From these tests I infer that it is neither lignite, sulphuret of antimony, or bituminous slate. Not having chemical apparatus at my disposal here, I was unable to apply any other tests. I may add that when applied in powder moistened to black iron and subsequently polished, it gave to it a fine brilliant metallic gloss like genuine black lead.

I would recommend that specimens be sent for the inspection and opinion of some professional geologist, and also that its market value be ascertained: when this is determined, steps may be taken to work the mines. As the 2nd quality of Cumberland plumbago sells for about £100 per cwt., I think the value of this vein ought to be considerable.

On the western side of the gorge near its entrance is a great mass of what appears to be plumbago, reposing against a wall of eruptive trap rock, and much changed and indurated by the heat it has been subjected to. This mass appears to be about 40 tons as far as explored.

There is at the first sight an appearance of stratification owing to the deposit occurring between the beds of the stratified rock, but the plumbago itself is found in masses of variable size, and in general quite detached, though in some cases the rock all round is full of plumbago, mixed with finely divided micaceous particles.

These masses are of every variety as to quality; some are hard and compact of almost pure plumbago, and in my opinion of sufficiently good quality to be suitable for the manufacture of drawing-pencils; the second sort, equally pure, but of a softer texture and easily reduced to powder.* This variety might be used to mix with antimony for the manufacture of common pencils or along with the inferior varieties it would find a ready market in India as well as at home, for the manufacture of friction grease for machinery, especially for railway wheels where there is great heat. At present, plumbago is not much employed for this purpose, but it is only owing to its rarity and high price that this is the case. Its other uses as a powder are numerous; of it are made crucibles, cells for galvanic batteries for the electric telegraph, a good polishing powder for black iron, and when ground with oil it forms an excellent and permanent black paint. Were the present limited supply in the market somewhat increased, no doubt many more useful applications of it would follow.

The hills in the neighbourhood show such peculiarities that I am induced to believe that they contain metallic deposits of either copper or lead.

Specimens of the plumbago dug from different masses, exhibit great differences of appearance; some show a distinct crystalline form; others, and these are the largest in quantity, are filamentous in structure, while a considerable quantity is altogether morphous. The filamentous variety seems to be hardest, and likely to be of the greatest commercial value when also compact, but in many of the deposits of it there is a large admixture of micaceous sand, which gives it a loose and friable texture."*

The Chemical Examiner of the Punjab, to whom a specimen of this plumbago was referred, reports that on examination he finds it principally composed of carbon with iron, and resembles English plumbago very closely. The mineral sent presents the lamellar form, and its specific quantity varies from 2·2 to 2·6. Its analysis gave the following results:—

In grains 1000, the constituents are,—

Water, ...	43·54
Salts soluble in water, ...	0·80
Sulphates, ...	0·45
Chlorides, ...	0·35
Sesqui-oxide of iron, ...	32·94
Carbonate of lime,... ...	8·37
Silica and alumina, ...	129·89
Carbon, ...	784·52

Part of the iron appears to be in the form of a sesqui-oxide, and the rest combined with the carbon.

SULPHUR.

Sulphur is called "gandhak," "gogird," or "kibrít." When in vitreous state it is called auṅlásár, which term, means like the "auṅlá," (fruit of the *emblic Myrobalan,*)† This fruit (known to Europeans as the Indian gooseberry) is yellow when ripe, and semi-transparent, hence the vitreous sulphur is said to resemble it. It is sometimes called "chachya," when in the form of "flower of sulphur," in which state it is first obtained from the ore by sublimation: roll sulphur is occasionally imported. It is found extensively throughout the Salt range, and is manufactur-

* I have tried some of this plumbago cut into cubes, and it appears to answer well as a soft dark grey drawing crayon.—ED.

* The Memo. of Dr. Thomson has been published in full in the Punjab Gazette.

† Sár, like áuwlá or áṅnlá, fruit of *Phyllanthus emblica*.

ed also at Kubát. The valley of Púga, in Ladákh, from whence borax is obtained, yields also sulphur.

SIMLA.

95.—[716]. Sulphur fused in cake from Jeura, near Simla. MR. GEO. JEPHSON.

96.—[717-734]. Are specimens of fused sulphur from Jálandhar, and [746] is from Amritsar.

Both are imported for medicinal purposes.

DERA GHAZI KHAN.

97.—[928]. Fused sulphur from the Higher Hills. Dera Ghází Khán. MUNICIPAL COMMITTEE.

KANGRA.

98.—[283]. Sulphur, from Lahaul. TARA CHAND.

The Puga sulphur mine is situated a short distance from the Rulangchu, (a small stream which is full of hot springs and runs into the Indus,) at the foot of a gypsum cliff. The mineral occurs chiefly in the form of the lamina disseminated throughout the rock: but in all the fissures there are numerous detached crystals quite transparent, and of all sizes, from that of a grain of sand to one-eighth of an inch. In detaching the sulphur, the crystals are mostly reduced to powder and partially mixed with the gypsum rock: in this state it is carried to the markets of Núrpúr, Kangra, and Rámpúr. The vague statements of the shepherds, make the annual supply about 500 maunds, but I should think that it rarely amounted even to half of that quantity.*

It is probable that the sulphur has been deposited in crystals, and is still deposited in the same manner in the fissures of the mica schist by aqueous vapours loaded with sulphur. This deposit is always met conjointly with a fibrous gypsum, with the fibres generally straight, parallel, and of a silky appearance. I am led to believe that this sulphurous deposit continues to operate thus on account of the moist heat you feel when you enter a few paces into the cavern from whence the mineral is extracted. On the 26th July 1854, at half past 6 A. M., the thermometer in open air, stood at 52° Fahrenheit, while at thirteen or fourteen feet in the interior of the mine, the mercury rose to 75°, and the glass of the instrument was covered with an aqueous vapour. I was suffocated by the puffs of humid heat of an odour similar to that developed by sulphur boiling in water. I have not the slightest doubt that if galleries were made in the body of the mountain, large quantities of the mineral might be extracted. In the actual state of things the mine is worked without system, and the workmen have not the remotest idea of purifying the mineral.

* Cunningham's Ladákh.

DERA ISMAIL KHAN.

99.—[525]. Sulphur ore, associated with gypsum in small crystals. Sulaimaní hills. LOCAL EXHIBITION COMMITTEE.

RAWALPINDI.

100.—[384]. Rock containing sulphur. Murree hills. LAHORE MUSEUM.

101.—[895]. Sulphur from Gobra hill. LOCAL EXHIBITION COMMITTEE.

KASHMIR.

102.—[603]. Sulphur, from Ladákh. H. H. THE MAHARAJA OF KASHMIR.

SHAHPUR.

103.—[907]. Sulphur earth from Jabba, above petroleum springs. MR. MATTHEWS.

104.—[908]. Sulphur obtained therefrom.

Besides the numerous springs charged with sulphuretted hydrogen, and which deposit sulphur on the rock over which they pass, and on the grass and weeds by their sides, sulphur in a mineral form occurs near the surface of the nummulite limestone at Jabba, a little above the petroleum springs, in a white porous gypsum, which has evidently been formed by the decomposition of the limestone, unaltered pieces of which are still imbedded in it. The metamorphosis has doubtless been effected by the action of sulphuretted hydrogen and sulphurous acid. These gases, generated on the decomposing alum shales by passing through the fissured limestone and porous gypsum that overlies them, become mutually decomposed, and sulphur is deposited. Dumas, in 1846, proved that where sulphuretted hydrogen at a temperature of above 100° Fahr., or better still near 190°, comes into contact with certain porous bodies, a catalytic action

is set up by which water, sulphuric acid, and sulphur are produced. In this way sulphur is universally formed in nature, and even in volcanic countries no well authenticated instance is known of the sublimate of sulphur in an uncombined state.

The thickness of the sulphur formation is trifling. The mineral is bright yellow in color, and small in quantity. It was formerly worked by Mahárája Guláb Singh, who ceased because it was unprofitable, and set up works at Khushálgarh on the Indus, between Attock and Kálábágh, where it is said to exist in considerable quantity. The place is called Nákband: it is in the Kuhát district, about 8 miles from the mouth of the Kuhát river, and specimens from it are exhibited.

"MISR GEAN CHUND, now Tehsildar of Pind Dádan Khán, told us that during the three successive years, he had from Nákband extracted 1000 Lahori maunds of sulphur for the manufacture of gunpowder for the Sikh army. He supplied it at the rate of Rs. 6 a maund. He described the pits as 30 or 40 feet deep.

The mode of extracting the sulphur from the matrix is simple. A hole is dug in the ground over which a large wide-mouthed earthen "ghara" or globe-shaped jar is placed. This is filled with crushed sulphur ore; a second ghara, with a large hole in the bottom, is put mouth downwards, on the top of the first, and a third and a fourth on the top of the second. The mouth of each jar being over the hole broken in bottom of the one beneath it, all communicate with each other, and at the joints a luting of clay is applied to fix them. The hole dug under the first or lowest ghara containing the ore, is then filled with wood and set on fire; the sulphur is thus sublimed out of the matrix, and rises into the upper jars, on the sides of which it is deposited as "flower of sulphur." The process is complete in eight or ten hours.

KUHAT.

105.—[961]. Series showing sulphur in various stages—as ore, sublimed sulphur, and cake or fused sulphur. LOCAL COMMITTEE.

106.—[961]. Earth, containing sulphur, from Gumbat.

The mines are not now permitted to be worked. The process of extraction formerly adopted was that already described. Sulphur also occurs near Panobar, 4 miles from Shadipúr on the Indus. The crystals of native sulphur picked out of the rock are called "aunlisár."

107.—[962]. Sulphur, as it comes from the receiver before melting. "Phúl gogird," flower of sulphur.

108.—[863]. Manufactured sulphur.

This is a flat cake prepared by fusing the powdered sulphur, and allowing it to cool in flat earthen vessels.

PESHAWUR.

109.—[573]. Sulphur, Kálábágh. Value 10 Rs. a maund. LOCAL COMMITTEE.

PETROLEUM AND BITUMEN, &c.

110.—[4304]. Petroleum, Himálayas. LAHORE MUSEUM.

111.—[4307]. Do. purified, forming a yellow colored strong smelling oil, called "pattar ka tel."

KANGRA.

112.—[ ]. Petroleum from British Lahaul. DR. H. CLEGHORN.

113.—[740-1]. Petroleum from beyond the Káuikorum range. MULVI UMRDIN OF NURPUR.

RAWALPINDI.

114.—[896]. "Tel gandak," petroleum floating on water of the spring. Ratta Hotar hills. LOCAL EXHIBITION COMMITTEE.

The petroleum is found at Jabba, a hamlet of Kussan, west of Chakrála, and about nine miles east of Kálábágh; at Dhádur, three miles west of Kabbakhí in the Salt range; at Narsinghpúr, in the Salt range; at Jabba, near Núrpúr; in the Algad ravine, at Kafirkot, on the Indus, and in smaller quantity at some other places.

A sample of this petroleum has been sent to England; but the report was very unfavorable.

The report states that it was impure, being combined chemically or mechanically, with extraneous adjuncts which greatly diminished its value. Details are not given; the chief impurities are merely said to be probably sulphur and phosphorus; but it appears possible that some impurity may have been due to the mode of collecting the large quantity ordered on that occasion. At all events this one adverse report should not be considered final, the report on the

previous small quantity from the same place having been favorable.

Petroleum is nearly indicated with bitumen on the one hand, and naphtha on the other, between which it occupies an intermediate place ; the principal distinction being a difference of consistency and color. Bitumen in its several varieties known as mineral pitch, asphalte, pisasphaltum, &c., is solid or nearly so, and black or dark colored ; naphtha is perfectly liquid and light in color ; petroleum,—earth oil, or rock oil,—is vescid or oily and greenish or reddish brown in color. They are resinous minerals or mineral resins, the products as it is generally understood, of the distillation of various bituminous rocks or soils, and their distinctions, classification, and alliances, are not very clearly determined or uniformly agreed upon. Petroleum is considered to be naphtha in its natural impure condition, more or less discolored and otherwise affected by foreign accompaniments derived from the adjacent soil or rocks. It is very generally associated with sulphur.

The principal supply of petroleum in the regions adjoining the Indus now under consideration, namely, at Jabba, near Kálábágh, is in nummulitic limestone* At Kafirkot, Dr. Fleming says, it exudes from brown bituminous sandstone. The mineral oil is usually found floating on the surface of certain springs, it is thus at Jabba, near Kálábágh, at Kafirkot, and at a spring in the Kuhát district, about four miles from Hungoo Khota and six from the Indus. It is observed that in the petroleum rocks which have many fissures, the supply is generally most abundant. Besides the ordinary method of sinking shafts, it is sometimes obtained by laying bare the stratum producing it, removing the surface earth in banks where it is found to exude. In the ravine at Kafirkot, where the springs issue from the sandstone, "large holes are dug which fill with water mixed with petroleum." Till the Punjab petroleum localities have been further examined and tried, the extent and value of their produce cannot be properly known.

It appears that the present cost of the Kálábágh petroleum, before despatch down the river, may be reckoned about Rs. 3 per maund.

It is probable that by the use of wells, the quantity obtainable would be so largely increased that the cost (after paying the initial charge of sinking the well,—which may be considerable, as they are often of great depth and sometimes unsuccessful) may be greatly reduced ; and at the same time being collected in this manner, it may be obtained of greater purity. At present it is collected by the natives, who plunge into a pool containing petroleum, a bundle of grass and shake it about. The petroleum or asphalte adheres, and this is scraped off with the hand into an earthen "ghara."

With regard to the uses to which it may be applied in this country, it has been tried with success in the Punjab, (as in Burmah and elsewhere,) for protecting woodwork, office record racks, &c., from the attacks of white-ants. This is an application of no small value, and it should be extended.

Major Robertson, when in charge of the Lahore and Peshawur road, tried it for the protection of the wood-work of timber bridges. He reported unfavorably, and found vegetable tar to be better suited ; but he did not report that petroleum was unsuccessful in protecting the wood, but that it was no better than the other, and he objected that it had no drying property. It is not stated that he had it boiled with vegetable resin, which is frequently done.

For the feet of telegraph posts it would probably be valuable. It might also be worth while to apply it to railway sleepers.

It gives a good light burned in the usual way with cotton wick, but generally accompanied with a good deal of smoke. It may be purified by distillation, and then either used as an oil or by gas made from it; it might be found a not unsuitable means of lighting the Attock Tunnel, which, when it is opened on the full size, will be a matter of some importance. It is probable that it would be found at Attock, less expensive than any kind of vegetable oil.

Candles are made of paraffine, a substance obtained by Mr. Warren De La Rue's process from Burmah petroleum, and also produced by distillation of coal and other minerals of disputed relationship to coal. They could not however be made profitably except on the large scale, as now at Messrs. Price and Co.'s Patent Candle Manufactory.

Paraffine oil, obtained by the distillation of petroleum of coal, &c., is a lubricating oil of much value for machinery of all kinds, as it does not injuriously affect brass or other metals.

The petroleum itself, when pure, is sometimes used for the same purpose without distillation.

The distillation of the oil might easily be effected in this country and the experiment tried.

It has recently been used in America, as a substitute for coal and wood in generating steam. The boilers and furnaces require to be made of a peculiar construction for its use ; but on the Indus, where wood is scarce, it is possible it might sometimes be found of value for this purpose.

At Bákú, on the shores of the Caspian Sea, is a petroleum locality well known for ages past, (and possessing a peculiar interest in connection with India as a place of Hindoo pilgrimage at the present day

* Mr. W. Theobald, Jour. As. Soc., Bengal, vol. xxiii.

and maintaining a small fraternity of resident Brahmins, attendants on the sacred fire of the petroleum springs). The viscid mineral is rolled up into balls with sand, for the purpose apparently of obtaining a fuel in a convenient form.

At the same place, and at many others, petroleum is used also as covering for the flat roofs of houses; probably mixed with sand in this application also, and forming a sort of asphaltic concrete to which an approach is obtained by the composition called orophonlite, often used in this country at the hill stations.

Petroleum has also been well known from ancient times, and in many countries, as a very efficacious remedy in certain cutaneous affections, both for man and beast. It has been successfully used in European practice in Burmah.* In the Trans-Indus, where it is found, Northern Deraját, &c., it is the common application for sores on the backs of camels.

It is also successfully used for rheumatism, and has other medicinal uses. COLONEL YULE was informed that it is used in Burmah as a medicine taken internally. HANWAY mentions certain complaints for which the Russians so use it, as well as its external applications.

Petroleum in one form or other has been largely used in many countries as an igneous missile in war; to which purpose the produce of these petroleum springs on the Indus appears to have been applied in former times.†

KASHMIR.

115.—[604]. —— called "momyái," is a black substance principally clay, which however burns feebly and softens slightly to the flame of a lamp, giving out a peculiar empyreumatic odour. The *momyái*, "osteocolla" of native medicine, is also, when genuine, a substance of this class; but it is of very high price, and its use is solely medicinal. The specimens purchased often consist of solified mineral tar, or still oftener of lignite. (See Division III, *ad loc.*)

EARTHS, CLAYS, AND OCHRES.

RED EARTHS.

The number of these is considerable; although varieties that receive different names are often extremely similar. Some of them are in use as medicine, others as dyes and coloring agents, and as such are imported from Hindústán, and become articles of considerable trade. The earths and clays to be met with in the bazars are known by the names of *geru* and *geri*, *gil-i-irmani*, *gil-i-khardya*, *gil-i-abrorshi* or *farsi*, *gil-i-makhtum* and *harmuchi*.

116.—"Geru," from the lower hills of the Dera Ghází Khán, and also from the Máhrúli hills of the same district.

A specimen is also exhibited from Bunnoo [No. 565], to which place it is imported from Afghánistán, and is used for dyeing cloths red. It is a hard red laminated earth, sometimes used in dyeing, and also by school teachers who grind it up with water and teach their children to write with it on wooden slabs, like our school slates. This material has also a place in native medicine.

The next few numbers describe earth and marls of a similar nature, but differing in tint and in hardness.

Samples also are sent from Amritsar, (Nos. 4515 and 762), from Jálandhar (721), and Lahore (No. 426), though not produced in either of these districts, but as being in use there.

117.—[849]. "Gil-i-khardya," exhibited from Lahore bazar, is a variety of geru.

118.—[884]. "Gil-i-abrorshi" of Amritsar bazar, is a pink clay, hard but less brittle, and paler than "gil-i-irmani."

119.—[759]. "Gil-i-makhtum." Amritsar bazar. LOCAL EXHIBITION COMMITTEE.

A variegated earth, deep red, and pure white, soft and irregular; it contains clay, carbonate of lime, and sesqui-oxide of iron.

It is exhibited from Lahore. (No. 840). The "gil-i-abrorshi," or "gil-i-farsi," (No. 790,) is probably the same or very nearly so.

120.—[884]. "Gil-i-irmani." Lahore bazar, differs very little from geru and gerí.

It is a rough, red, brittle earth, occurring in laminated masses, used as a color, and also as a medicine by native practitioners. This is the representative of the "bolus Armeniacus," once so celebrated as a European medicine. It is now only used in Europe for coloring dentifrices, tooth powders, and also added to improve the appearance of potted meats and anchovy sauce.

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* Indian Annals of Medical Science, No. iii.

† See Note H, to Sir H. Elliot's Mahomedan Historians of India.

121.—[428-4513]. "Harmuzi" or harmuchi, from the Lahore and Amritsar bazars. The earth is much used for house painting, also as an artist's color, and as a medicine; it is a fine deep chocolate red color like that yielded by our artists' "brown madder," only opaque.*

GURGAON.

122.—[144]. Red earth, brought from Gwalior.

A soft bright red earth in flat pieces.

123.—[141]. "Badóchi." A red dye, from Gurgaon. DEPUTY COMMISSIONER.

124.—[142]. "Geru surkh." A coarse red earth, of deep red chocolate color, lamellar rough texture from Gwalior. DEPUTY COMMISSIONER, GURGAON.

This is called geru, but is exactly like harmuzi.

The Dera Ghází Khán sample of "geru" is not unlike this.

SIMLA.

125.—[144, 176, 181, 186, 199, 188]. Are red ochreous earths from Dhámi, Bishahr, Kumharsen, Mahlog, Kothár, and Koti, in the Simla district.

KANGRA.

126.—[258]. Red earth, Bawarnah. LOCAL EXHIBITION COMMITTEE.

This is used to adulterate "kamela," the red dye obtained from the capsules of *Rottlera tinctoria*; it is also used as a glaze for pottery.

127.—[260]. Is a red earth, from Haripúr.

Besides these earths, ("surkh mitti" of the vernacular catalogue,) specimens are exhibited from Rawalpindi, (455,) from Bhulla in Jhilam, (496,) and from Dera Ismail Khán, (532). This last is of the color of "harmuzi."

128.—[261]. "'Udi mitti," from Haripúr, in the Kangra district. LOCAL EXHIBITION COMMITTEE.

This earth takes its names from its color ('údi, meaning chocolate purple color)—it is used for coloring pottery, and is probably allied to the harmuzi.

Among the sandstone strata at Dhurmsala and in other places in the Kangra district, there are beds of marl and clay of a deep red and chocolate color: to these formations the samples in question very probably belong.

129.—[318]. "Chamarfo," Spiti. P. EGERTON, ESQ.

A bright deep red colored earth used in dyeing.

130.—[320]. "Chasarfo," orange colored dye, Spiti, a bright orange colored earth. P. EGERTON, ESQ.

131.—[323]. "Lal mitti," red clay, from Spiti. P. EGERTON, ESQ.

SHAHPUR.

132.—[511]. Harmchi or harmuzi. Red earth, from Chitta, in the Salt range. DEPUTY COMMISSIONER.

RAWALPINDI.

133.—[455]. Pink marl, from Aktori hill. LOCAL COMMITTEE.

This marl has a soft and almost greasy feel.

PESHAWUR.

134.—[570]. "Gormuchai." Yusufai country, Peshawur. LOCAL COMMITTEE.

Value 10 Rs. a maund; is erroneously called red lead in its district list, but is harmuzi.

135.—[581]. Red ochre, "surah khaorah," from Lund Khor, Yusufai. PESHAWUR COMMITTEE.

DERA GHAZI KHAN.

136.—[548]. A dark-red smooth ochreous marl, from the Lower hills. TEHSILDAR OF DERA.

This is a fine colored marl, lamellar in structure, but with conchoidal fracture.

YELLOW EARTH AND OCHRES.

There are clays colored by the hydrated

* Besides the above named red earths, which are sold in bazars, several districts exhibit various red earths, marls, and ochres, as specimens of their own production, there are some of them made use of in manufactures, other not so, they now follow arranged in the order of their districts.

sesquioxide of iron. They are found in various parts of the province in the Salt range, at Kálábágh, and other localities.

137.—[143]. Yellow ochre, passing into red ochre, from Firozpúr of Gurgaon.

[133½] Lamellar yellow ochreous earth, from Singhána. Deputy Commissioner of Gurgaon.

Yellow earth, "zard" or "píli mitti," as also exhibited from

Haripúr, of Kangra (259).

Kheura, Salt range (493).

Márí of Shahpúr (508).

This sample is a square block cut from the smooth yellow clay.

Jálandhar district (718).

Lahore bazar (427).

Dera Ismail Khán (527).

138.—[179]. Black earth, from Kothár, Simla. Rana of Kothar.

Black Earth.

A similar sample is [189] of Kotí.

These are black clays abounding in organic matter.

JHILAM.

139.—[498]. A brownish clay.

Fuller's Earth.

140.—[545]. From Yára of Dera Ghází Khán. This is a genuine fuller's earth, marked "mitti sabz khúrdani." It is eaten by women during pregnancy.

RAWALPINDI.

141.—[456]. "Mitti gáchni." Local Exhibition Committee.

This is a soft and saponine drab-colored earth, something like fuller's earth, sold in small pieces; it is used for cleaning the hair, also in medicine; is to be met with in every bazar, where it is called "mitti Múltání" or "gil-i-Múltání."

Samples are also shown from the bazars of Lahore and Amritsar. Nos. 742, 839, 840.

In the report by Captain F. R. Pollock, on Dera Ghází Khán, it is stated that this Múltání mitti is imported to Dera Ghází Khán from the interior of the Western Range (Sulaimani) to the extent of 10,000 maunds.

The name "Múltání" applied to the earth does not indicate its origin, except perhaps as regards the trade in it. The Assistant Commissioner of Múltán, Lieut. Corbyn, writes as follows:—

Although it would appear Múltan is famous for its mitti or earth, yet there are no mines or pits here which produce the substance. It is imported from the sandy and rocky tracts of country lying to the south and west of Múltán. It is of the following descriptions:

1st.—White mitti, which is termed "khajrú" or eatable.

2nd.—Yellow mitti, which is termed "bhakrí," and is used by the poorer classes for dyeing cloths, &c.

3rd.—Light-green, or "sabz mitti," which is chiefly used by natives for washing and cleaning the hair.

The first is imported from Jaisulmair and Bikanair in quantities of 1,000 maunds, valuing Rs. 1,000.

The second is also imported from the above places to the extent of 1,000 maunds, valuing Rs. 875.

The quality, No. 3, is imported from a village named Vadúr, in the Dera Ghází Khan district, about 200 maunds annually, valuing Rs. 150.

GLASS MAKING.

The art of glass-making is yet in its extreme infancy in the Punjab, as may be seen by a glance at the collection in the Department of Manufactures. In fact the specimens of white clear glass, are one and all manufactured by melting up fragments of European white glass vessels. The only glass of native manufacture from its first elements is a coarse greenish "kach," or glass in lumps. Glass is little used by the natives for any of the domestic purposes for which in Europe, it is considered almost a necessary of life; hence there has been but little encouragement given to the manufacture; no doubt, if search were made, the province could produce fine sands and good alkalis, suited to an improved manufacture.

GURGAON.

142.—[151]. Glass-making sand, from Chatta in the Firozpúr Tehsil, Gurgaon. Deputy Commissioner.

The glass sand occurs in the form of a whitish sand mixed with an alkali, which effloresces naturally. It is called reh, that only of a good white color makes glass. This substance is identical with the alkaline efflorescence which appears in many parts, and whose presence is destruction to cultivation wherever such an efflorescence occurs over clean sandy soil, there is naturally formed a mixture of sand and alkali which fuses into the course lumps of bottle green glass.

143.—[ ]. Crude fused glass, called "kach." Singháná.

KASHMIR.

144.—[609]. Peroxide of manganese. Jammú Territory. H. H. THE MAHARAJA OF KASHMIR.

This is used in glass-making, to destroy the green color of glass by converting the *protoxide* of iron into *peroxide*.

LAHORE.

Manganese is found in the bazar as a binoxide, called "jugní" or "missí siya."

145.—[871]. Lump of fused or raw glass. "Kach." LAHORE BAZAR.

POTTERY.

The pottery clays are better represented. Clay exists abundantly all over the province, and in some places of a fair quality. The commonest kind is the gray clay, which burns red; but there are several earthen vessels in the collection showing the clay, when burnt, of a yellowish white or cream color; such clay mostly comes from Dera Ghází Khán, Dera Ismail Khán, and Kuhát. Several of clay vessels of Hazara exhibit a black clay. As yet, however, no pale-colored clay suited for Terra Cotta, like the beautiful samples from Madras, have appeared.

The subject of the production of kaolin has received attention. Some disintegrated granite, forming kaolin has been brought down from Dalhousie, where it is to be had in plenty, but the cost of carriage is great.* This kaolin has been tried, and the vessel in baking received a colored tinge, and did not stand pure white. This is said to be caused by the presence of iron, but may have been the fault of the furnace, rather than the material.

DELHI.

146.—[14]. White clay, supposed to be kaolin. Aurangpúr, Delhi. MUNICIPAL COMMITTEE.

This is white clay with some carbonate of lime and mica, and may very likely have been formed by the disintegration of granite. It has been employed for making crucibles in the Foundry at Roorkee, N. W. P.

KANGRA.

147.—[282]. Kaolin, Lahaul. R. ELWES, ESQ.

This is not kaolin but a very fine grey sand, and does not appear to possess tenacity.

148.—[308]. Fine clay, from Spiti. P. EGERTON, ESQ.

DERA ISMAIL KHAN.

149.—[528]. Pottery clay. Dera Ismail Khán. LOCAL EXHIBITION COMMITTEE.

The box contains also sample of a whitish gray clay, a black clay, and a red earth, used for coloring pottery.

LAHORE.

150.—[432]. Common pottery clay, from Kot Khoja Sáí, near Lahore. MR. B. POWELL.

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* The whole surface soil of Dalhousie consists of disintegrated primary rock, schist, and granite, more or less enriched and discolored by iron and by decayed vegetable matter, but in many places the paths cut in the hill side are as white as if made of chalk, and crumbly pieces of whitened rock; both schist and granite may be gathered with the hand, soft and friable as dry pipeclay. On the road to Chamba, and also on the hill road into the Kangra district, there are places so whitened with the disintegrated rock as to impress the spectator with the idea that he is approaching a chalk cliff in several places. I have noticed that the white material had been dug out and was employed by the hill people as a whitewash, the disintegrated mica schists of the softer varieties, form a whitish saponine powder used for a similar purpose.

151.—[160A] "Kharya mitti," fire clay. Lahore bazar.

This is a pale colored clay, almost the same as "chikni mitti," and used to make crucibles of. The term "khari mitti" is also applied to chalk. But there is no indigenous chalk in India; there are many white clays and substances similar in chemical composition to chalk, but there is no secondary cretaceous formation.

152.—[ ]. "Kaolin," from Dalhousie. Dr. Penny.

[ ]. Kaolin worked up into clay.

[ ]. Small covered pots made of the kaolin, but unbaked and unglazed. Lahore Central Jail.

[ ]. Small baked and glazed jug of kaolin. The color has changed from white and got a yellowish tinge in baking. This is said to be owing to the presence of iron in the kaolin.

This kaolin was brought from Dalhousie. It is ground up, and the fine powder collected in running water and separated; the coarser particles are again taken up and ground, till the whole is reduced to an impalpable powder.

SHAHPUR.

153-54.—[514]. Series of pottery clays. Deputy Commissioner.

Consisting of (1) gray clay for pottery found at Nalli; (2) similar clays from Surakhi; and (3) a sample of smooth lamellar marl, from Dhák and Khusháb. Specimens of the pottery made from this clay will be found in Class XV., Division II.

GUGAIRA.

155.—[521]. Clay, from Syadwala, Gugaira. Deputy Commissioner.

DERA ISMAIL KHAN.

156.—[528]. Clay, "chikna mitti," very porous, from Dera Ismail Khán. Local Committee, Dera Ismail Khan.

DERA GHAZI KHAN.

157.—[558]. Pottery clay from Dájal. Tehsildar of Dajal.

158.—[550]. Clay for brick-baking, from Dera Ghází Khán. Tehsildar of Dera Ghazi Khan.

159.—[551]. Porous clay for vessels from Dájal, Dera Ghází Khán. Tehsildar of Dera Ghazi Khan.

SUB-CLASS (B.) FUELS.

COAL.

Of the various samples of coal that are exhibited, there is hardly one, as the Jury remarked, that can properly be so called. There is, however, a coal from near Pind Dádan Khán, and a sample from Kashmír, that are very similar to genuine coal of the carboniferous formations, but the majority of the specimens are anthracite and lignites. They occur in irregular patches of variable, but usually of inconsiderable, extent, in a number of places in the Punjab. In the Kangra district, in Dera Ismail Khán, among the Murree hills, and in Jummú, there are several places where glossy black lamellar lignite is found associated often with shales, containing sulphate of iron, and belong to strata of tertiary formation.

But the principle source to which attention has been attracted is the Salt range, for here at any rate the quantity is much greater than most of the other localities indicated.

In the Salt range there are two of the formations coal or lignite. These I shall distinguish as oolitic coal and tertiary coal.

I. Oolitic coal.—Among the shales of the oolitic series occurs, what is called Kálábágh coal, which has to a certain extent been employed as fuel for the Indus steamers. This bed is in a ravine about a mile west of Kálábágh. The coal is found in lumps of various sizes in dark bituminous shales. It does not occur in beds but in detached masses, which appear to be compressed and fossilized trunks of trees; in many cases the junction of trunks and branches can be traced. The occurrence of these masses is altogether irregular and uncertain, and nothing like a systematic working or shaft-cutting, to reach it, would be in any degree remunerative.

"The coal," says Dr. Fleming, "is very hard and light, exhibits a conchoidal fracture in which its woody structure is most apparent. It is of a jet-black color, has a brown streak, and often encloses nests of half-decomposed wood resembling peat."

It burns quickly without coking, to a light colored ash, and emits a large amount of smoky yellow flame; on being distilled, it yields a light spongy coke of a glistening metallic color, with a large quantity of inflammable gas. On analysis the following results were obtained in 100 parts:—

Carbon (coke), ...	37·5
Volatile (bituminous inflammable matter), ...	60·0
Ashes, silica, &c., ...	2·5
	100·0

The large amount of bituminous matter at once refers the coal to the lignite or coals imperfectly carbonized; the amount of ash is small, which may be accounted for by the solid nature of the wood not admitting of the infiltration of earthy matter.* This coal burns very rapidly.

* Flemming's Report. Selected Correspondence of the Punjab Government, No. xxii. page 310.

The evaporative power of coal is in direct ratio to the amount of carbon it contains. English coal yields 50 to 70 per cent. of carbon, this coal only 37·5; hence double the quantity of this coal would be required: but still it has twice the evaporative power of wood, which has only 16 to 18 per cent. of charcoal.

During 1850, Dr. Fleming tell us, 2,500 maunds of this coal were dug, and from 1851 to March 1852, 2,126 maunds, at the rate of 8 maunds per rupee, which could not remunerate the miners for any length of time. Calculating that an ordinary steamer burns 600 ℔s. an hour of English coal, and that of Kálábágh coal, the consumption would be nearly double, from considerations adduced above,—the whole produce of the year 1850 would keep a steamer going 166 hours.

II. Tertiary coal.—The most important series of coal strata in the range, however are the beds occurring in the strata of the eocene series. It is principally in the lower alum shales that coal occurs; it is found at many places all along the range, and also across the Indus in Chichalli range.

The first coal occurs at *Baghanwalla*, 10 miles west of Jalálpúr, being about half way between it and Pind Dádan Khán. The seam is about 3½ feet thick, at its widest part and gradually thins out towards either end. It is enclosed in shales and yellow marl, resting on variegated sandstone. The seam dips conformably with the strata at an angle of 45° or 50°. This coal was brought to the notice of Government in 1847. It is very brittle and alternates in parts of the seam with shale, which renders it also very friable. There would be considerable difficulty in sinking shafts on account of the brittle nature and the steep incline of the strata. But Dr. Fleming notices this seam as the most hopeful one to be worked, should Government determine on mining the coal.

At *Drengan*, coal again appears, which is probably a continuation of the Baghanwalla seam.

Kheura, this coal was found in 1848, in a seam about 2 feet thick at the bottom of a roundish hill of nummulitic limestone, in a ravine about a mile to the N. E. of the Salt mines. It rests on blue clay containing septaria and crystals of gypsum. In 1849, 500 maunds were extracted, but this is not a productive seam, as the extraction appeared to have exhausted it.

On the road from Kheura to Choya Saidan Sháh, coal occurs at *Pid;* the coal is not so good, it occurs in two seams. At Dindhot, Mukrach and Núrpúr, coal occurs in a seem of about 2 feet thick, of inferior quality, and difficult of access.

At the top of Karmiwán above Kuthá, shales full of iron pyrites occur, enclosing beds of coal much more compact and mineralized than most of the other lignites; the seams were only about 6 inches thick. In 1852, Dr. Fleming remarked that the outcrop of the coal had become concealed by huge masses of limestone thrown down by an earthquake.

Between Kuthá and the Indus no coal occurs, except in occasional and unimportant films. But at Kutkí, in the Chichalli range, among the alum shales, coal was obtained; the miners stating that it occurred only in patches, and not in regular seams; access to it is easy, and it burns well, notwithstanding the quantity of earthy matter it contains.

The coal of the Salt range generally very much resembles that called *splint coal*, but is soft and brittle. It is not used as fuel by natives, but ground to powder and administered with milk as an "osteocolla" for wounds and broken bones, internally. It is often called "sang-i-salájít," and sometimes "*múmiái*," though múmiái properly is hardened bitumen or petroleum. The genuine múmiái is derived, it is said, from the Bakhtyárí hills in Persia.

The coal is difficult to ignite, but when lighted gives out a quantity of smoke having an empyreumatic odour, and burns without coking, with a considerable amount of flame and heat; it leaves however a large quantity of ash, in which respect it is unlike the coal of the oolitic series, previously described as found at Kálábágh. Generally speaking, the coal is free from iron pyrites, but some of that brought for trial to the Punjab railway was said to have omitted a smell of sulphur during combustion, which is a common fault of lignites generally. The coal is better adapted for combustion than for smelting ores, to which purposes it is not applicable, because it yields but a small amount of coke, and cannot produce the high and continued heat required for smelting operations. The total length through which the coal occurs is 130 miles, in the nummulitic formation, hence the total quantity in existence must be considerable. But the steep angle at which the seams lie, and the friable nature of the supervening beds, render shaft-sinking difficult; carriage is also very difficult in many places.

The coal is of the kind called brown lignite; it has a brown streak, and when freshly dry a black glossy lustre, like the jet coal above described; it contains occasional nests of a semi-mineralized substance like peat. Some of the Baghanwalla specimens, however, that have reached Lahore are of a much superior character, they are very like real coal, and have a black streak on being scratched. No indications of fossil wood have been obtained in the shales, but one or two shells.

The following are Dr. Flemming's analyses of the coals:—

Baghanwalla, No. 1.

Coke (carbon), ...	41·36
Volatile (bituminous inflamable matter), ...	40·64
Ashes, ...	18·00
	100·00

Baghanwalla, No. 2.

Coke, ...	59·705
Volatile (inflammable matter),...	38·455
Ashes, ...	1·840
	100·000

No. 1 was from the upper part of the seam, and No. 2, a remarkably fresh fine specimen, from the centre.

Kutki, Alum Shale Pit-coal.

Carbon (coke), ...	35·579
Volatile (bituminous inflammable matter), ...	36·421
Ashes, ...	30·000
	100·000*

* For the sake of comparison, the analysis of several varieties of English coal, showing the amount of carbon contained in each, may profitably be consulted.

100 Parts of each sort Contained—

	Carbon.	Bituminous.	Earth-ash.
Kilkenny coal, ...	97·30	..	3·70
Swansea, ...	73·53	23·14	3·33
Newcastle, ...	58·00	40·00	..
White Haven, ...	57·00	41·30	..

Professor Ansted remarks, that no good coal occurs in England or Europe out of the regular carboniferous series, but oolitic coal is abundant in America; and there does not seem any reason on this account why coal should not be found in India, among oolitic and tertiary strata, and capable of being successfully worked. The existence of the seams being indicated, and an analysis of the coal effected, it only remains to make careful and well-judged experiments to determine the ultimate success of coal-mining on the Salt range; but we must ever bear in mind, and especially with regard to promises of coal in the Sub-Himaláyan and other tertiary formations, that lignite is apt to occur in detached irregular masses, which are no more indications of a regular workable seam of serviceable coal, than the fortuitous discovery of a copper coin is of the propinquity of a copper mine.

The subject has received renewed attention of Government in this year (1864). Professor Oldham and Dr. Jameson have visited the localities, and coal has been sent down and burned on the Punjab Railway, where it answered perfectly, but we have as yet no promise of the establishment of remunerative coal mines;—the principal difficulty appears to be the very heavy cost of carriage to the places of consumptions.

The general conclusions we come to on the subject of the coal formations in the Punjab appear to be these:—

1st. That we are in no measure to be deterred by the statement so often but erroneously put forth, that coal as serviceable fuel does not occur out of the carboniferous series. The discoveries of Professor Rogers in America, and the works of Rániguuj in Bengal, not yet determined to be of the real carboniferous series, sufficiently prove the fallacy of it.

2nd. That the existence of coal and the laws of its production in the country can only be determined by esoteric observation. The observations already made seem to lead to the conclusion that there are two formations of coal in the range; the first, is that belonging to the nummulitic eocene period; the second, like the Kálábágh coal, to the oolitic or secondary. From observations of the nummulitic limestone and the discoveries of small portions of coal in parts of the Sulaimaní range and near Dera Ghází Khán, as well as the formations recently noticed in Sindh, and thence upwards through Dera Ismail Khán, Bunnoo, Wazírí hills, Murree, &c., a probability is established of the uniform continuance of strata of the series containing thin beds of lignite of greater or less development, among shales and sandstones, across the whole of that portion of the frontier country between Sindh and the Salt range, including the Dera Ghází Khán, Dera Ismael Khán, Bunnoo, Kuhát, Shahpúr, Jhilam, and part of the Rawalpindi districts. On the other side also, the appearance of coal or lignite in the tertiary formations in the Jammú territory in the Kangra district, and again at Biláspúr, indicate an equally wide range of such strata on the other frontier to the north and north-east.

The seam of nummulitic coal appears to attain its greatest development at Baghanwalla, a place 8 miles west of Jelálpúr, close under the southern scarp of the Salt range, and at the entrance to a gorge through which a stream issues; the way is up this gorge, and at a distance of about 3½ miles from the village the seam becomes visible. Here the coal is in a bed 3½ feet thick or in all probability not so much except where it crops out, as it has the appearance of having been squeezed very much, and to have here found a more roomy space where it could somewhat expand. The coal is partly friable, but good bright coal can be obtained. The beds dip at an angle of 63°, and also in other places at 58°, which would necessitate the working by galleries one over another, and then the whole of the coal might be worked out. Care must be taken to keep the galleries clear of dust and

small coal, as spontaneous combustion might, and often does ensue from the decomposition of the iron pyrites, &c., which is abundantly contained in it. The coal is good, notwithstanding that it emits a somewhat sulphureous smoke; it succeeds on the rail-road, and for steamers on the Indus; one maund of this coal is as effective as $2\frac{1}{2}$ to 4 maunds of ordinary wood fuel.* With regard to the quantity of fuel available at this place, Dr. Oldham writes as follows:—

"Taking Baghanwalla then, as unquestionably the most promising of any of the localities, we can here make a rough approximation to the quantity of 'coal,' which will be available at a moderate cost, that is without going to any great expenditure for machinery, or other such appliances. I put aside altogether any calculations of what may occur (and I suppose does occur) at depths to which it most indubitably would not pay to drive the workings for such a coal as this.

"At Baghanwalla, the seam, when cut through in the water-course, was 3 feet 6 thick, occasionally a little more. This I have already given my reasons for considering to be more than the regular or general thickness of the bed. To the west, the bed holds on steadily in direction, but gradually thinning out for more than a mile; to the east it can be seen for more than quarter of a mile. We may, therefore, take the whole length as about 2,000 yards, and we may take the average thickness as 2 feet 6 inches, the portion which lies above the water level, and which is therefore most readily accessible and could be worked by adits, without pit-sinking, may be taken on the average as 100 feet into the rock. We should then have 6,000 × 2·5 × 100 feet = 15,00,000 cubic feet of coal; take from this ten per cent., to allow for irregularity of beds, and we would have 13,50,000 cubic feet, which may roughly be taken as equivalent to maunds. This would be equal to about 45,000 tons of coal. If the workings were carried down, say 50 feet, below the water-level, and I scarcely think it would pay to go much further, we should have in addition to the quantity given before, 6,000 × 2·5 × 20 equal to 3,00,000 cubic feet, or deducting as before one-tenth, equal to 2,70,000 cubic feet, or maunds of 'coal,' making a total of 16,20,000 cubic feet or maunds of coal.

"From this, at least one-fourth must be taken for waste, small coal, dust, impurities, &c., leaving 12,15,000, or in round numbers 12 lakhs of maunds of coal. This quantity ought, I think, to be available here, 12,00,000 maunds equivalent to about 40,000 tons, is however a quantity so insignificant that the prospect of such a return would not justify even a small expenditure of mechanical appliances, and the difficult roads which would have to be made better, before the coal could be transported is also a great source of expense."†

It appears that beyond Baghanwalla the seam of coal divides into two, which gradually thin out towards the west, for at the next station, Kheura, the coal bed is observed to have in it some seams of shale; beyond that the beds are separated each 3 feet; beyond that again at Chamil, they are 8 feet apart; and at Sakesar, 100 feet, the shale and sandstone beds becoming thicker and the coal less. The lower beds of strata are more productive than the upper, so that at no place but Baghanwalla would working be remunerative, and even there remuneration would be questionable for any diggings beyond what might be locally consumed, or applied in the immediate neighbourhood.

* Memorandum on the results of a cursory examination, &c., page 21.

† It will be proper to add, however, that persons of local experience say, that more coal has already been dug out than the total quantity above indicated.

Dr. Oldham observes that all the localities which have recently been examined, and from which there is any likelihood of obtaining coal, have been known for more than ten years past, and he considers that the Salt range, whatever the value of its coal for local consumption, and the supply of steamers on the Indus, can never be a permanent scource of fuel for the province, either for the purposes of domestic use, or for the railways and factories that are now multiplying around us, with the increase of capital and the extension of knowledge.

Dr. Oldham concludes that the chief value of these coal deposits will be to *supplement* the ordinary wood fuel, and that thus it is worth while economizing it, but that it will not ever supplant wood fuel. The cost of carriage to Múltán would be nearly a rupee per maund (to say nothing of the cost of the coal itself), and since about three maunds of wood are equal to one maund of coal in effect, and the price of three maunds of wood is generally about Rs. 1, the coal would not be cheaper than wood.

With regard to the oolitic coal of Kálábágh. It is very limited in quantity, it does not form regular beds, but owes its formation to masses of wood which were drifted into the mud, which formed the shales in which the lignite now occurs. Hence this coal will only occur in limited masses, and can only be valuable as a fuel for the Indus steamers coming to Kálábágh.

The coal, says Dr. Oldham, does not form probably more than one twenty-fifth of the mass of the strata containing it; and calculating on these data, the whole bed now above water, would not on excavation yield more than 40,000 cubic feet. If the works were carried down below the water-level, say 20 feet, 10,000 cubic feet more might be obtained, deducting what would be waste, &c., about 45,000 maunds might thus be obtained. Dr. Oldham, is of opinion that the coal could not be supplied at Rs. 3 a maund for long; and that it would not be advantageous to establish any machinery, but simply to take what could be obtained for local use. In conclusion, there is not the remotest probability of coal being found above or below the beds alluded to.

In this general sketch of the prospects of coal in the Punjab, I have of necessity been unable to mention *all* the various localities where coal has been found. The reader will find all such details annexed to the names of the specimens in the immediate sequel, but few of these localities have attracted any attention, save for the production of lignite as a mineral curiosity. The small patches of coal occurring at several places among the Murree hills, were systematically examined by a committee formed by H. H. the Lieut. Governor, Sir Robert Montgomery. Samples of the lignite were sent for analysis to Calcutta, they presented the same general appearance as in other lignites, but the quantities in which they occurred were small and uncertain, and the supply in several of those places appeared to have been already worked out.*

The prospect of Kashmír coal, in the Jammú territory at one time attracted considerable attention, more especially as the Engineer who noticed the workings at Dundéla confidently reported the strata to be of the carboniferous series. Since then, however, the coal of Dundéla has proved to be like the rest of eocene origin among nummalitic limestones, but undoubtedly the coal may be of local value, a large lump now in the Lahore Museum might pass for "Wallsend," so good is its appearance.

* The detailed proceedings of the Committee have been published in a little pamphlet, called "Coal and Iron in the Punjab." Printed in 1859, at the P. W. Department Press.

The coal at Bunnoo, from the Wazírí hills, has been mentioned with some hope; and lately baskets of coal have come down as specimens from Kangra and Dharmkót, at Dharmsala, but these also are tertiary and limited in quantity; and at present, the verdict to be returned on Punjab coal, "is valuable only for local consumption and to supplement wood, not for export, or to supply the province at large."

KANGRA SERIES.

160.—[241-4]. Lignites, from Garti. Bawarnah, Jawálamukhí, and Derah on the Beyás. LOCAL EXHIBITION COMMITTEE.

The sample from Jawálamukhí is mixed with a bituminous shale, which is white from the efflorescence of an abundance of proto-sulphate of iron which it contains; the Derah sample is a hard lignite in thin uniform layers or tablets, coated with a yellowish substance on the outside.

Gopipúr, in the Kangra district, furnishes a lignite superior to either of these; a sample was sent to the Central Museum after the Exhibition closed; there is also coal at Dharmkót near Dharmsála.

161.—[381-2]. Two samples of lignite, from Biláspúr, near the Beyás river. LAHORE MUSEUM.

JHILAM.

162.—[463]. "Parrot coal." Kundal mountain. LOCAL EXHIBITION COMMITTEE.

This is a lignite, something like Cannel coal.

163.—[464]. Shale, from ditto ditto.

SHAHPUR.

164.—[499]. Samples of coal from the Salt range at Sangli, Choíwala, Súlakhí, &c. DEPUTY COMMISSIONER, SHAHPUR.

There are specimens of the best kinds of coal found in the Salt range. Samples have been forwarded to Múltán to undergo trial. On the spot, the cost of the coal is Rs. 5 per 100 maunds.

165.—[500]. Coal from Kálákos and Kálábágh. MR. MATTHEWS.

DERA ISMAIL KHAN.

166.—[524]. Coal, from Sulaimání hills. LOCAL COMMITTEE.

A poor hard lignite.

DERA GHAZI KHAN.

167.—[539]. Coal from Lagári hill. SIRDAR JAMAL KHAN.

BUNNOO.

168.—[552]. Lignite, Kálábágh. DEPUTY COMMISSIONER.

The quantity in which it exists is not yet ascertained, but is believed to be plentiful, and can be collected on the river's bank at a cost of three maunds per rupee.*

KASHMIR.

169.—[6012]. Sample of lignite, from the Jammú territory. H. H. THE MAHARAJA.

This lignite occurs at Kotlí in a bed from 15 to 18 inches thick.

Analysis of two specimens of coal from Kotlí.†

No. 1.		No. 2.	
Carbon,	90·5 p. ct.	Carbon,	90 p. ct.
Volatile matter,	4·0 „	Volatile,	6 „
Ash,	5·5 „	Ash,	4 „

170.—[613]. Salájít (lignite). Srínagar.

The place of production is not noted.

171.—[380-384]. Samples of Kashmír coal. LAHORE MUSEUM.

The principal place where coal was observed was in the Jammú territory at Dandela.

The rocks in the immediate vicinity of Dandela are thin carbonaceous shales and grits, with earthy ferruginous limestones; among them is "the bed or seam of coal or anthracite, varying in thickness from 1 inch to nearly 2 feet, undulating in chambers or bunches, more than in a continuous even seam." This is Mr. Calvert's description of the spot he selected, from which to take his samples, and it may serve

* Deputy Commissioner of Bunnoo.

† Extracted from the Official Correspondence on Coal and Iron in the Punjab.

as a favorable type of all that is actually visible. The strata he describes are thickly strewn with fossils of the nummulitic formation, which is characteristic of the lower tertiary period. From a close comparison of these rocks with the description given in Dr. Flemming's Report on the Salt range, there can be no doubt that these coal measures are the same as what is there described as "lignite or Salt range coal."*

* See a Tract, entitled "Coal and Iron in the Punjab."

The general character of the coal is that of a hard anthracite.

One of these is a large lump, much more like genuine coal than the lamellar lignites above enumerated.*

* There are many samples of a glossy lignite to be met with in the druggists' shops, called Salájit. They are not included here, but in Division V., as they are only kept in small quantities for medicinal purposes.

SUB-CLASS (C). SUBSTANCES USED IN BUILDING.

STONE, MARBLE AND BRICKS.

The first division contains sandstones, granites and primary rock, marbles, and limestones, other than those soft kinds, which are used only for burning, and included under "cements."

SANDSTONES.

DELHI.

The collection consists of a series of sandstones from Sahi Balabgarh, in the hills to the south-west of Delhi. It is exhibited by C. J. Campbell, Esq.

172.—[2]. White sandstone.

173.—[3]. Red sandstone.

174.—[4]. Spotted sandstone (red and whitish).

GURGAON.

175.—[115]. Flexible sandstone, from Dádri. Deputy Commissioner of Gurgaon.

HISSAR.

176.—[161]. Flexible sandstone, "sang-i-larzan," (*i. e.*, shaking stone,) from Dádri in Jhínd. Local Committee of Hissar.

This, and the preceding (115), are obtained from the Kalyána hill in the pergunnah Dadri, of the newly acquired Jhínd territory. Nos. 165 and 166, are samples from the same locality, sent by the Rohtak Committee. The stone is mostly used for roofing and for ornamental pillars.

SIMLA.

177.—[201]. Sandstone, with yellow mica. Hills near Simla. Mr. G. Jephson.

178.—[202]. Another specimen of sandstone, containing mica, from the same place.

KANGRA.

179.—[246]. Soft sandstone. Kangra. Local Exhibition Committee.

This is the sandstone ordinarily used for building at the station of Dharmsala.

180.—[247]. Soft red sandstone, Kangra. Local Exhibition Committee.

181.—[248]. Hard blueish sandstone.

This is but little worked, owing to its extreme hardness.

182.—[249]. Hard sandstone. Local Exhibition Committee.

This is a hard stone, but has a very pleasing appearance when cut. It is worked into monumental stones, &c.

183.—[334-335]. Two specimens of sandstone. Bakloh, near Dalhousie. Major Reid.

This sandstone appears to be geologically the same age as the Dharmsala sandstone.

They are probably of tertiary formation, and differ much in hardness. The traveller will notice these strata highly inclined, and presenting in some places the most picturesque and grand appearance on the road to Dalhousie; they are intermediate between the most recent conglomerate formation of the lower hills, and the schists of the upper. But, perhaps, the most striking exhibition of their inclined strata anywhere to be seen is, on the road to Sindhára on the Rávi; in one place the strata incline downward at a very steep angle to the edge of the river* and form high cliffs on either side; but these cliffs consist of

strata of various degrees of hardness, and all the softer portions here become much washed away from above by the action of rain or other causes, leaving only the harder beds of rock, which accordingly project like huge walls built down the cliff at a steep incline: on looking down the river, the eye follows wall after wall of these rocks, projecting like so many gigantic knife blades.

RAWALPINDI.

184.—[ ]. Calcareous sandstone, from Attock. MAJOR SANDILANDS.

JHILAM.

185.—[480]. Gray sandstone. Dumeli hill. LOCAL COMMITTEE.

186.—[481]. Red sandstone. Pabbi hill, Jalálpúr.

BUNNOO.

187.—[553]. Yellow sandstone, "zirah-rang-konha." Shaikh Budín hills.

188.—[534]. Black sandstone, "tora-rang-konha." Shaikh Budín hills.

GRANITE AND PRIMARY ROCKS.

189.—[250]. Granite. Kangra district. LOCAL EXHIBITION COMMITTEE.

190.—[304]. Greenstone. Kangra.

191.—[302]. Mica imbedded in quartz. Spiti. P. EGERTON, ESQ.

RAWALPINDI.

192.—[441]. Granite, from near Attock. MAJOR SANDILANDS.

JHILAM.

193.—[479]. Granite (?), from Choya Saidan-Shah, Jhilam. LOCAL COMMITTEE.

As no plutonic rock occurs in the Salt range this is a doubtful granite, unless it is a boulder extracted from tertiary conglomerated strata.—[B. P.]

LIMESTONES.

(Hard limestones not used for burning.)

HUSHYARPUR.

194.—[324]. Limestones, from Lower Sewalik range.

RAWALPINDI.

195.—[444]. Series of hard gray limestones containing sand. Mandra. LOCAL COMMITTEE.

The samples are as follows:—

[445]. Granular limestone, mixed with sand; from Bishender nallah.

[443]. Limestone containing sand and some mica, from Káli.

[446]. Earthy limestones, consisting of carbonate of lime with sand, like 445, only darker colored, from Rattiál.

196.—[450]. Hard argillaceous limestone. Bhai Khán river.

197.—[451]. Crystalline limestone. Khánpúr.

198.—[452]. Argillaceous limestone. Gúrah.

199.—[442]. Compact limestone, from Attock.

200.—[ ]. A variegated limestone, from the same place. MAJOR SANDILANDS.

Near Campbellpore a mottled limestone, variegated yellow and brown, is found. It is called "sang-i-abri," or "sang-i-tabak," and is made into pestles, mortars, cups, and plates, or fancy articles.

The rock at Attock is a very dense black limestone, often giving indication of iron.

SHAHPUR.

201.—[482]. Grayish-white limestones. Pabbi hill, Jalálpúr. LOCAL COMMITTEE.

DERA GHAZI KHAN.

202.—[541]. Limestone, from Chota Bála. JAMAL KHAN.

KUHAT.

203.—[538]. Khajúra stone.

A concrete deposit of lime. The sample is west

square piece, rough and porous. It may be called travertin.*

JHILAM.

204.—[471]. Limestone, (pink magnesian,) from Karúli hill.

205.—[472]. Compact white limestone, containing a little magnesia. Kúsak and Kundar.

206.—[473]. Mottled magnesian limestone.

This is a regular dolomite.

207.—[469]. White limestone.

208.—[483]. Compact limestone.

209.—[480]. White limestone, with sand in it (contains a little magnesia). Dúmelí.

HAZARA.

210.—[592]. Compact dark gray argillaceous limestone. Abbottabad. MAJOR SANDILANDS.

There are also some building stones exhibited from Balót and from Kuhát. Nos. 535, 536, and 537.

I have found cubes of sulphuret of iron in this limestone, along the banks of the Dorh river.

MARBLES.

DELHI.

211.—[5]. White marble, Sahi Balabgarh. C. J. CAMPBELL, ESQ.

212.—[6]. Black do. do. do.

213.—[7]. Gray do. do. do.

HISSAR.

214.—[163]. Inferior marble, "kalai-ka-pattar." Narnaul of Hissar. LOCAL COMMITTEE.

This is a marble which takes a good polish; nevertheless, it is much used for making the first quality of chunam (lime). Narnaul is in the Pattiala territory, 50 miles from Bhawáni.

GURGAON.

215.—[107]. Gray marble. Bhunsi. DEPUTY COMMISSIONER.

Not unlike Narnaul marble.

KASHMIR.

216.—[385-3861]. Samples of black marble. LAHORE MUSEUM.

A sample of this marble finely polished was also sent by His Highness the Maharaja. (No. 615.)

217.—[390]. Hard granular gypsum. Jammú. LAHORE MUSEUM.

JHILAM.

218.—[465]. White marble. Sardi mountain.

219.—[466]. Veined marble, from the same locality.

220.—[467]. Impure marble.

221.—[477]. Translucent marble, "safaid pattar," from Shahpúr, near Kúsak and Kundar.

PESHAWUR.

222.—[576]. Yellow marble, called "shah maksadi," from Manairi. Yusufzai. PESHAWUR LOCAL COMMITTEE.

Cut into charms and ornaments.

BRICKS AND BUILDING STONES.

223.—[210]. Specimens of bricks. Jálandhar. MR. TAYLOR.

224.—[501]. Building stones, from Kathá, at foot of the Salt range, Shahpúr.

They are sold for Rs. 12-8 a 100.

225.—[540]. Building stone, Choti Bála. Dera Ghází Khán. JAMAL KHAN.

SLATES AND ROOFING MATERIALS.

The series of slates exhibited are very fine. There is one immense slab, 12 feet long, from

* In the Lahore Museum is a piece of lime travertin, very similar in appearance; it was brought from the hills near Sihunta, on the road from Dalhousie to Dharmsala through the hills. The deposit is found in concrete, with beds of a pudding-stone, or conglomerate of great hardness, formed of pebbles of volcanic and primary rock, held together by a calcareous cement: the water in the neighbourhood is impregnated with lime.

the Dalhousie quarries. The slates are some of them mixed and veined like marble; they are generally of a blueish-gray tint not inclining to purple, nor have they the fine texture of Welsh slates, being much more schistose. They are used universally in the hills both for flooring and roofing purposes. Large quarries are worked near Dalhousie, where the schists present the utmost variety of appearance. Some of them are hard, and good for slates; others are micaceous, soft, and flaky, and extremely lamellar. They occasionally contain quartz and iron in irregular lumps. Sometimes the stone is white and lamellar, at other places it is found so hard as almost to lose its schistose character: some of the rock has become quite disintegrated, and in other places, especially near Katallagh, near Dalhousie, there are whole beds of micaceous schist so brittle, that great pieces can be detached with the hand, and these are found to be so extremely soft and sectile, that they separate almost as thin as sheets of paper. Many specimens are evidently marked and discolored by oxide of iron, and sometimes the surface of the slate is beautifully marked with a brown-colored tracery, like the crystalline flower-work that every one has noticed on a glass window during a frost. The cutting of slates for roofing purposes is somewhat costly, and even at the quarries they fetch a high price.* Occasionally they are brought to the plains, when an enterprizing contractor undertakes such a task, otherwise slate is but seldom met with. This mineral is acknowledged a medicine by natives, and called sang-i-Músá, "Moses' stone."

GURGAON.

226.—[109-114]. A series of slates from Firozpúr, Páli, Chimnáwar, and Sonah. Deputy Commissioner, Gurgaon.

These slates are the products of the hilly tracts of the Sonah, Páli and Firozpúr pergunnahs of the Gurgaon district.

The samples consist of a schist called "sail." It is only used close to the places of production.

SIMLA.

227.—[196-7]. Specimens of slate, from Simla. Captain G. Pengree.

This sample (196) is described as a slate that does not last long; (197) is a more durable kind, and there are temples roofed with it that have lasted hundreds of years. The Simla list calls slate, "chápar," *i. e.*, "roofing."

228.—[198-9]. Slate from Kasauli. Mr. Geo. Jephson.

CHAMBA.

229.—[336-345]. Series of slates from Dalhousie. Major Blair Reid.

No. 335. Is thick slate for building.

No. 337. Is suited for flooring.

The other samples are roofing slates; one of them is a fine specimen, nearly 12 feet long, No. 338.

RAWALPINDI.

230.—[439-440]. Two samples of slate from Attock. Major Sandilands.

KANGRA.

231.—[245]. Slate from Kanyára, near Dharmsala. Local Committee.

These slates occur under totally different conditions from the Simla and other slates. They are in structure almost crystalline schists, hence they are too coarse for many purposes to which slates are usually applied: but in point of durability, from their hardness, they are superior to the Welsh slates.

232.—[301]. Slate from Spiti. P. Egerton, Esq.

HAZARA.

233.—[591]. Slate from Abbottabad. Local Committee.

* As high as Rs. 8 per 100.

LIME.

DELHI.

234.—[8]. Common kankar. Calcareous concrete.*

235.—[9]. "Harsarû kankar."

There is a place in the North of the Gurgaon district, close to a ridge of small hills, from which this concrete is obtained, and from which it takes its name.

There is also a lime called "harsárú" prepared from it—which is described in the subjoined extract:—

"In the pergunnah of Jhársa, and close to the salt works near the Najafgarh jheel, are extensive excavations of limestone, much esteemed in the neighbourhood of Delhi. It is found in horizontal layers, varying from a foot and a half to two feet in thickness, at about four feet from the surface of the soil, and water is immediately beneath it and touching its lower surface.

"When first exposed, the stone is soft and easily broken, containing fresh-water shells, and not to be distinguished in color from the black soil in which it is found; on drying it assumes a gray hue and becomes very hard. It is a curious fact, that this formation when once removed is not reproduced. The workmen affirm that they have searched in spots which have not been touched within the last hundred years, and never found it where it is known to have been once quarried." †

At Delhi also a material called "bájri," which is disintegrated gneiss, collected from ravines, &c., is much employed as a gravel.

236.—[10]. Limestone, Sahi Balabgarh.

237.—[11]. Old mortar, from demolitions of ancient buildings.

GURGAON.

238.—[116-17-18]. Lime, from Narnaul and Firozpúr.

HISSAR.

239.—[162]. Kankar. Toshám. Local Committee.

Value Rs. 18 for 100 maunds at Bhawáni, for 1st, or "Chappar kankar;" Rs. 11 per 100 maunds, of 2nd, or "Rewasa."

Chappar and Rewasa are localities in the Toshám pergunnah, where kankar is found.

JALANDHAR.

240.—[209]. Kankar for making lime. Sikandarpúr. Mr. Taylor.

Kankar is also exhibited [520] from Syadwalla of Gugaira, and from Gujranwalla (434).

AMBALAH.

241.—[171]. A stone used for making lime, obtained on the hills at Manimájra, Kothár, and Kálásar.

242.—[172]. "Kankar," from Borhári. Local Committee.

In some parts of the Ambálah district, below the hills, the streams bring down such quantities of limestone, that the deposit is collected largely by the people, who burn it for lime; in former days a revenue of Rs. 2,000 a year was obtained from leases of lime kilns.

In the lower hills, at the foot of the great range, where wood and the stone is abundant, the kilns are erected; they are made of a cylindrical shape like a well, about 10 or 12 feet in diameter, and the same in height; there are two valves or openings to each furnace. The kiln is then charged with a fuel consisting of green wood, and the stone to be calcined is put on the top; and the whole is ignited during 36 hours. Stone is thrown on to the kiln little by little, in four days the whole cools, and the stone is found to be calcined and of a white color; this is slaked by throwing water on it, and the result is chunam or lime in powder. In some places the kiln consists merely of a hole dug in the ground.

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* *Memorandum of experiments on, and analysis of, specimens of kunkur, from about the 393rd mile-stone on the Grand Trunk road, near Naubutpore.* By Lieut. C. H. Dickens, *Artillery. 19th September*, 1849.

The following is the result of analysis:—

Carbonate of lime,	40·05		The sand contained some alumina, probably in igneous combination with the silica.
" of magnesia,	1·24		
Silica,	1·80		
Alumina,	1·75		
Iron,	4·75	49·59	
Sand,	34·00		The last probably in part from soluble salts, for which no examination was made.
Water,	13·35		
Loss,	3·06	50·41	
		100·00	

The first five ingredients are the active constituents of the mortar. Arranged in percentage of their sum, they stand thus:—

Carbonate of lime,	81·1
Carbonate of magnesia,	2·3
Silica,	3·6
Alumina,	3·5
Peroxide of iron,	9·5

† Report on Zillah Gurgaon. Appendix, page ix.

The following Table shows the localities and out-turn of the lime manufacture for the last three years. From the office of the NAWAB OF MALER KOTLA.

Year	Place.	No. of furnaces.	Quantity of lime made.	Manufacture costs per 100 maunds.	Value of out-turn.
			MDS.	RS.	RS.
1861	Sangrel and Mathání, ...	18	23,800	14	3,332
	Chakigalla, ...	20	25,000	...	3,500
	Chandi, Garyálí, and Thal, ...	9	20,000	...	2,800
1862	Sangrel and Mathání,...	9	7,000	12	660
	Chakigalla, ...	5	1,000	14	140
	Chandi, Garyálí, and Thal, ...	10	12,000	...	1,680
		7	5,000	...	700
1863	Sangrel and Mathání, ...	10	13,000	14 to 15	1,280
	Chakigalla, ...	5	3,000	14	420
	Chandi, Garyálí, and Thal, ...	8	12,000	...	1,680

SIMLA.

243.—[192]. Limestone. Baghat. RANA OF BAGHAT.

KANGRA.

244.—[251]. Pink or red-colored limestone, "chúna-ka-pattar." Giroh tahsil. Kangra. LOCAL EXHIBITION COMMITTEE.

LAHORE.

245.—[387]. Slaked lime, "kalai," used for white wash.

246.—[388]. Lime, "chúnah."

247.—[389]. Quick lime, "áhak."

SHAHPUR.

248.—[505]. Lime, from the Salt range. MR. MATTHEWS.

This is exhibited as "plaster of Paris," but it proves on testing to be slaked lime. No doubt plaster of Paris is produced, seeing that gypsum exists in abundance;—probably this is only a mistake, both being white powders.

249.—[510]. White earth, from Chita, Salt range. DEPUTY COMMISSIONER.

This white earth contains common lime, a trace of sulphate and a little salt, the sample has imbedded in it some recent fresh-water shells, a *helix*, and a little spiral shell.

No. 492, from Jhilam, erroneously called gypsum, is exactly similar.

250.—[518]. Pumice stone. *(Sic)* Kathá. DOCTOR HENDERSON.

This cannot be a pumice stone, seeing that no volcanic scoriæ or tertiary volcanic rocks exist in the range; it is probably a recent calcareous tuffa or travertin deposit.

GUJRAT.

251.—[457]. Rolled limestone. Bhimbar nallah. LOCAL EXHIBITION COMMITTEE.

This limestone is called at Gujrat, "chanchal-ka-pattar" or "chúna-ka-pattar." It is found in the bed of the Bhimbar nallah, and in the rivers Chenab and Jhilam. It occurs also in small quantities in the Pabbi range of hills in the Gujrat district. There are two varieties: one of a dark blue, and the other of a light gray color. The former is somewhat harder, and well adapted for metalling roads; the other yields the best lime when burned. Limestone is the principal material used in metalling that part of the Lahore and Peshawur road lying between the rivers Chenab and Jhilam. When consolidated, it makes a hard and very durable road, and although not quite so smooth as kunkur, is much more lasting. Most of the limestone for this purpose is procured from the beds of the Chenab, Jhilam, and Bhimbar, and as it has often to be transported for long distances on camels' backs, its cost, including carriage, varies from Rs. 8 to 14 per 100 cubic feet.

The fuel, generally used for burning the limestone, is the wood of the "pullahi" (*Acacia modesta*). 200 maunds of wood are required for every 100 maunds of limestone. This yields about 50 maunds of lime. The lime sells at the rate of Rs. 25 per 100 maunds.

252.—[459]. Chunam, from Gujrat. Local Exhibition Committee.

JHILAM.

253.—[495]. Lime from Tilla mountain. Salt range. Local Committee.

DERA ISMAIL KHAN.

254.—[531 and 33]. Lime, from Pahárpur and Kuhát.

GYPSUM.

Gypsum or alabaster—the harder varieties are often suited for ornamental carving work, as marble. There is a white granular gypsum of this nature in the Jammú territory. The other gypsums are softer, and only fit for burning to form plaster of Paris or "gach."

SIMLA.

255.—[179]. "Makol" gypsum, from Kothar. Rana of Kothar.

The sample consists of white granular gypsum in pieces; several other Hill States show similar samples. No. 192 is probably the same, though called limestone. Indeed, the mistake is not to be wondered at, since the gypsum is constantly called "chún-ka-pattar" in the hills. I visited some gypsum diggings at Bátri, near Dalhousie, where the soft gypsum is so called, from which the gypsum is taken to Dalhousie, burnt, and used for a white wash in all the buildings. The gypsum occurs among slate schist strata, which, however are very hard in texture just above the veins; in some places the rock just above the gypsum was almost like a chert. The vein of gypsum was over 5 feet thick, clear and white in the centre, but the upper and lower part of the veins were much streaked with the matrix rock.

KANGRA.

256.—[291]. Gypsum, from Spiti. P. Egerton, Esq.

257.—[321]. "Kársi," native soft gypsum, containing also a little carbonate of lime, from Spiti.

258.—[292]. Alabaster, from Spiti.

A hard white granular gypsum. This is a good gypsum.

259.—[293]. Gypsum granulated, white but soft.

RAWALPINDI.

260.—[391-2]. A sample of fibrous gypsum. Murree hills. Lahore Museum.

These specimens are flat pieces having a striated crystalline appearance. They have evidently formed portions of thin veins of the substance occurring in the rock. It is probably a kind of foliated granular gypsum.

SHAHPUR.

261.—[484]. Gypsum. Kheura. Deputy Collector, Kheura.

Gypsum occurs in the marl beds of the Devonian or primary strata of the Salt range. It is found either in irregular beds or in detached masses; whenever it occurs in beds, it is much cracked and the fissures are filled with red marl or a bluish clay. Beds of it seem to lie above and below the salt. In some localities the strata of gypsum are remarkably bent and contorted. The mineral is for the most part of a light gray color, with a shade of blue and translucent on the edges. It has a saccharine appearance, but masses in which a coarse crystalline structure prevails, are by no means uncommon. Red varieties also occur (a sample is exhibited from Jhilam) and beds of a dark gray earthy gypsum are generally associated with the saccharine kind. It is nearly a pure sulphate of lime without any carbonate. When calcined, it yields a plaster of Paris, but plaster of Paris without carbonate of lime, is less coherent as a cement than when it contains from 10 to 12 per cent. The best plaster would be obtained therefore by mixing some lime with it. Natives only use it mixed with pure lime into mortar to give the shining marbly appearance to the finer kinds of chunam work. From Pind Dádan Khán any amount might be obtained.

It is in the gypsum of Mári, Kálábágh and Sardi that the beautiful regular quartz crystals (called Kálábágh and Mári diamonds) occur. They are transparent, milky, or red. The specimen marked "Bohemian topaz" of the Jhilam collection con-

sists of small crystals of this quartz, in the form of dodecahedra, or double six-sided pyramids, but there is not the six-sided prism so characteristic of quartz. The Kálábágh diamonds are quartz in six-sided prisms, terminated by six-sided pyramids. In the Keila Wán, above village Khond, crystals of iron pyrites occur in beds from which a sulphur spring issues, depositing sulphur in the gypsum over which it flows.*

262.—[910]. Sang-i-jeráhat, a sulphate of lime. Kheura. Salt range.

JHILAM.

263.—[468-9]. Gypsum, or inferior alabaster. Sardi and Karúli mountain.

Erroneously called "marble."

264.—[470]. Red alabaster, from Kúshak and Kundar mountains. Deputy Commissioner.

DERA GHAZI KHAN.

265.—[543]. Selenite, from Yáru. The Tehsildar of Yaru.

266.—[544]. Fibrous crystalline gypsum, called "jaráh," from Sangar. Tehsildar of Sangar.

PLASTER OF PARIS.

267.—[54]. "Gach," plaster of Paris, from Lower hills.

"Gach" is ordinarily found in the bazars in round cakes; the calcined gypsum having been mixed with water, and thick substance thus obtained dropped down in circular cakes and left to dry.

KASHMIR.

268.—[608]. Makol, gypsum. H. H. The Maharaja.

269.—[614]. Gach, plaster of Paris.

AMRITSAR.

270.—[4537]. Pándo. Amritsar bazar. Local Exhibition Committee.

A good sample of plaster of Paris.

GURGAON.

271.—[146]. Makol.

This is an artificial cake, and contains a little powdered mica.

SANG-I-JERAHAT.

(Soapstone or steatite.)

This is a substance employed in carving and ornamental work; it is also ground up with lime and employed to give chunam work a fine smooth surface and polish.

GURGAON.

272.—[631]. Sílkari, steatite, from Singhána. The Deputy Commissioner.

PESHAWUR.

273.—[575]. Soapstone, or steatite, "sang-i-jeráhat." Shahkot, Yusufzai.

KASHMIR.

274.—" Sang-i-palauń," French chalk, a substance resembling steatite, used for making crucibles. Bánihál hills, Jammú. H. H. The Maharaja.

MICA OR TALC.

This mineral, besides being used as a substitute for glass, is largely used, pounded up into powder, and mixed with lime to form a beautiful glistening plaster. This may often be observed in ornamental native buildings, when the interiors are finished with shining pearl-like plaster, which has been embossed with flower work, pannellings, &c.

GURGAON.

275.—[146]. Series of micas, from Mahanti and Bhunsi. Deputy Commissioner.

One of these is a fine specimen in large plates; another is tinged red from the iron earth it is near; a third is a piece of hard micaceous rock, having a

* The bulk of this information is derived from Dr. Flemming's "Account of the Salt Range."

reddish, and in some parts, purplish, tinge, which is ferruginous mica-stone (No. 158.) The fourth specimen is a glistening micaceous shale having micaceous fine particles; and the last is a soft and brittle red-mica schist having a pink lustre.

276.—[12]. Talc in pieces. Sahi Ballabgarh. C. J. Campbell, Esq.

277.—[13]. Talc pounded for plaster. Ditto.

SIMLA.

278.—[1827]. Black talc, "abrak siyah." Sirmúr. Rana of Sirmur.

KANGRA.

279.—[264]. White mica, from Jagatsukh, Kúlú. Local Committee.

280.—[265]. Black mica. Barágarh, Kúlú. Local Committee.

PESHAWUR.

281.—[574]. Mica paste, "mattai shagga," from Swat. Local Committee.

This is mica ground up with lime ready for application as an ornamental plaster. Value Rs. 1-8 a maund.

KASHMIR.

282.—[605]. Talc, from Hasora. H. H. The Maharaja.

SHAHPUR.

283.—[903]. Talc, from Mári. Mr. Matthews.

SELENITE.

BUNNOO.

284.—[561]. Clear selenite in crystals, from Kálábágh and Esakhail. Deputy Commissioner.

KANGRA.

285.—Selenite. Local Exhibition Committee.

This is in a thin layer with beautiful pearly white lustre.

CEMENTS.

DUGSHAI.

286.—[206]. Cement stone unprepared. The Himálayas. Mr. D. Oliver.

[720]. Ditto, prepared for use.

[208]. Ditto, in balls.

These balls were plunged into water immediately on being made, showing the drying powers of the cement. If the cement is taken in a powdered state and kneaded with the hand into a mass, in about three minutes it becomes warm to the feel, and if then plunged into water it hardens immediately. These samples are deserving of special notice.

287.—[534]. "Surkhi," pounded brick for mixing with lime and mortar.

PLASTERS.

RAWALPINDI.

288.—[453]. Fine white clay. Rawalpindi. Local Exhibition Committee.

JHILAM.

289.—[491]. Hard white marl, erroneously called French chalk.

SHAHPUR.

290.—[509]. A smooth blue clay, from Chitta, in the Salt range. Deputy Commissioner.

HAZARA.

291.—[593]. Blue clay, from Dharmtura and Salhad, used as a plaster for houses, Abbotabad. Local Committee.

KASHMIR.

292.—[606]. White clay. Jammú. H. H. The Maharaja.

GURGAON.

293.—[135]. Soft white clay, from

Bhunsi. Deputy Commissioner, Gurgaon.

SIMLA.

All these Hill States exhibit a soft white earth, called in several of them "makol." The term makol is also applied to gypsum and plaster of burnt gypsum.

294.—[175]. White earth or pipe-clay, from Kumharsen. By The Rana.

Nos. 180, 181, 187, 191, are similar earths from Mahlog, Dhámi and Balsán.

PESHAWUR.

295.—[582]. Crude chalk, "spinah khaorah," from Land Khor, Yusufzai. Local Exhibition Committee.

Probably a white clay. The entire absence of cretaceous formations in upper India renders *chalk* a thing almost unknown, except as imported in pieces for use on the black boards in schools. What is called chalk usually proves to be plaster of Paris; white clay or lime which, though it may occur of the same chemical composition as chalk, is not a consistent mineral such as is properly called chalk.

SUB-CLASS (D). MINERALS USED AS IMPLEMENTS IN PROCESS OF MANUFACTURE.

296.—[393]. Lithographic stone. Salt range. Lahore Museum.

This is a fine close-grained limestone, but not so hard as European lithographic stone. An indigenous stone of this description is a great desideratum, since the principal part of native printing is by lithograph. At present European stones are imported and sold by weight at high prices,—some kinds of native stone are in use, but the European are always preferred for the finer kinds of work, and where great sharpness of delineation is required in the print.

FIRE CLAY.

SHAHPUR.

297.—[513]. Fire clay, from Kafir Kot. Mr. Matthews.

A white clay with occasional streaks and patches of red and blue in it.

PESHAWUR.

298.—[575]. "Shaukanrai," from Shahkot, Yusufzai. Local Committee.

Fire clay, used for lining and making furnaces, ovens, &c. Price 1 rupee per maund.

JHILAM.

299.—[497]. "Matti chikni," or fire clay, from the Tilla and Bhulla mountains, Salt range. Local Exhibition Committee.

It is a white clay just like 297.

KASHMIR.

300.—[616]. Fire clay, "sang-i-dalam," from Srínagar. H. H. The Maharaja.

This is a good hard yellowish fire clay.

Clay used by metal workers for making crucibles, which they do by beating up the moistened clay with a quantity of flocks of cotton wool to give it tenacity.

301.—[627]. Artificial facing sand, for foundry use. Roorkee Workshops. Major Allen.

302.—[624-5-6]. Porous bricks, called "jháwah." H. H. the Maharaja of Kapurthalla.

They are used as flesh rubbers or scrapers, as pumice stone is used in Europe to remove ink stains.

SHAHPUR.

303.—[617]. Flint, from Kálábágh and Namal. Mr. Matthews.

BUNNOO.

304.—[563a]. Flint, "patr-i-atish." Namal hills, Pergunnah Miyániwála. Deputy Commissioner.

Occurring in beds of eocene formation of a whitish limestone, not unlike chalk; the flints have a regular chalky white coating.*

305.—[583]. Whetstone, "shurah shiggai," from Nílah. Local Committee.

This stone has glistening lustre. Price Rs. 1 each.

306.—[585]. Cutler's sand, "bat shigga."

Used by cutlers and iron workers in sword grinding; value Rs. 1-4 a maund.

307.—[586]. "Kurund" corundum, from Nílah.

HISSAR.

308.—[159a]. Sang-i-kara. From Dádri in Jhínd. Local Exhibition Committee.

A hard and very heavy stone of horn-blende rock, too heavy for building.

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* See Geological Sketch of the Salt range, at the end of the 5th Division of this Class.

MILLSTONE.

PESHAWUR.

309.—[584]. Millstone, "Maichanekanrai," from Palandra, Yusufzai. Local Committee.

Price Rs. 1 a pair.

HISSAR.

310.—[960]. "Sang-i-chakki." millstone grit, from Dádri. Local Exhibition Committee.

ASBESTOS.

BUNNOO.

311.—[4964]. Asbestos, "sang reshadar." Khost valley, beyond the border.

This remarkable mineral exists in flat beds or vein above the Khost valley, and could be procured in considerable quantities. It is said to be twisted into rope by the hill people of those parts. Its most curious property is indestructibility at a red heat—on this account it is utilized in England in gas stoves. Little tufts of asbestos being fixed in front of a series of small jets, these when ignited heat the asbestos red, which gives the appearance of a regular fire.

Asbestos has been woven into fabric but as a curiosity only.

A specimen of hard fibrous gypsum is exhibited without indication as to whence it came. It is a curious specimen like a collection of long stiff bristles in a glistening mass.

The collection did not contain any specimens of materials used as a glaze for pottery. A hard siliceous stone or quartzoze rock is used, finely pounded together with powdered "kach," or coarse glass.

Mr. Thornton mentions, in a Memo. on the Delhi district, a substance called "burbura," which he says is probably a form of felspar, and is used in the manufacture of porcelain and in polishing glass.

SUB-CLASS (E). SUBSTANCES USED FOR ORNAMENTAL PURPOSES AND FOR PERSONAL DECORATION.

DELHI.

312.—[15]. Rock crystal, from Aurangpúr.

Natives are extremely skilful in carving rock crystal. The manufactured department shows many samples of workmanship in beads, cups, &c.

The village of Aurangpúr is situated in a small valley surrounded by hills, and the roads leading to it from all sides are, for a distance of three miles at least from the village, impassable to any but foot passengers and cattle, from their rocky and precipitous character. The mines themselves are situated about two or three miles to the south-west of the village, and can only be approached by paths like those just described.

The crystal does not occur in its primitive position, but in a secondary deposit of siliceous breccia very highly impregnated with iron. Each crystal is encased in a sheath of hæmatite.

It would appear that the rocks in which the crystal was originally formed, have been disintegrated and broken up at some early geological period, and the debris have been consolidated into the porous breccia by the long continued action of heat and moisture under great pressure. Water having a large quantity of iron in solution has then permeated the mass, and by depositing the metallic oxide has bound together the siliceous particles in a ferruginous matrix.

The general character of the range in which this deposit occurs is that of thick beds of a blueish gray quartzose rock, alternating with coarse red sandstone and breccia. Throughout the whole range there is evidence of very great disturbing forces, as the beds are all inclined at high angles; but nowhere in all the extent which I have examined, are there more evidences of violent disturbance than in the neighbourhood of Aurangpúr.

The deposit of crystal occurs in a small valley or basin among those hills, about two or three miles to the south-west of the village of Aurangpúr. The valley is about 500 yards long, and from 50 to 100 yards broad, and dips towards the north. The only part of the deposit which has been worked is the south end.

The works have hitherto been carried on in two ways:—1st, by open pits gradually sloping downwards; 2nd, by wells and shafts. Of the former there are two, neither of which have been worked for many years. Neither is deeper than 20 feet from the surface. Of the latter there are three, the deepest of which was sunk by the late Rajah of Ballabgarh, and is 20 feet in depth, and about 10 feet in diameter. From the bottom several galleries extend for a short distance on all sides. The two wells are of much less depth.

The strata passed through by the deepest shafts are not uniform for more than the first half of the depth; at first they are the same as I have described, and highly ferruginous. Subsequently the rock begins to lose the iron, and a short way down is composed of small pieces of pure quartz embedded in a matrix of almost pure white clay. I have not been able to ascertain in what way the crystal occurs in these beds, but the Lumberdars of Aurangpúr inform me that it is here the largest and the purest specimens are found. In the upper ferruginous beds are layers of red clay, which I consider to have originally been kaolin, and subsequently impregnated with iron.

In the upper strata many of the crystals are tinged with yellow from an admixture of iron.

I took a man with me from Roorkee as a guide. For some time previously a considerable quantity of the white clay had been annually brought to the Roorkee Workshops as a valuable furnace material.*

GURGAON.

313.—[119]. Crystals from Bhún. Deputy Commissioner.

KANGRA.

314.—[252]. "Zahr múhra." Suket. Raja of Suket.

315.—[253]. Cup of "zahr múhra." Ladákh and Thibet. Local Committee.

"Zahr múhra" is a stone, which is supposed to crack and split if poison is put into it; hence its

* Extracted from Dr. Thompson's Report on the Mines; published in the "Punjab Gazette."

name. In Europe a similar superstition prevailed as to Venetian glasses, and in the middle ages, the opal was believed to lose its color at the sight of poison!

The kind of zahr múhra, called "khatai," is a hydrate of magnesia, and most esteemed by the natives as a medicine.

316.—[384]. "Jál mor," from Balti. Tara Chand. In the Lahaul collection.

It is used like zahr múhra for cutting into cups, &c.; the value of a cup is from Rs. 3 to 4.

It is a dark hard serpentine-like stone, takes a fine polish.

317.—[290]. Red quartz, from Spiti. P. Egerton, Esq.

318.—[295]. Granular white quartz rock, from Spiti.

SHAHPUR.

319.—[503]. Quartz crystals. Kathá.

There is also a very interesting specimen, showing these crystals imbedded in a matrix of granular gypsum, which preserves their shape and smooth polish from all contact.

A similar series are exhibited from Kálábágh, in the Bunnoo and Lahore collections, Nos. 394 and 558.

320.—[506]. "Sang-i-abri," mottled stone. Kálábágh. Mr. Matthews.

RAWALPINDI.

321.—[ ]. Sang-i-tabak.

A stone similar to sang-i-abri; cut into plates, cups, &c.

KASHMIR.

322.—[610]. Rock crystal. Srínagar. H. H. The Maharaja.

323.—[611]. "Zahr múhra," serpentine. Skardo (from Little Thibet).

JHILAM.

324.—[485]. "Bohemian topaz," from Kúshak hill.

Small dodecahedral crystals, very perfect, of reddish quartz.

SIMLA.

325.—[184]. Species of turquoise. Bishahr. Raja of Bishahr.

KANGRA.

326.—[280]. "Turkis," from Lahaul. Tara Chand.

This gem is said to be brought from Thibet proper or China. The principal ornament of the Ladákhí women is a head band, hanging like a long tail, and studded all down with large turquoises; this is called "berák," and often even with common people worth Rs. 20 or 30.*

The price, however, of these stones must have increased of late years, for Mr. Egerton says that, the berák sent to the Exhibition, which was an inferior one, cost Rs. 80. The Nono of Spiti is also described as having great difficulty in collecting stones for his daughter's head-dress. (*See* Journal of a Tour through Spiti, p. 58.)

327.—[281]. "Támbra," (lit. red or copper colored gem.) Tara Chand.

A kind of garnet, or jacynth, used for rosary beads; said to be brought from Persia by Kábul merchants.

328.—[289]. Garnets. Spiti. P. Egerton, Esq.

329.—[305]. Garnets in quartz. Spiti. P. Egerton, Esq.

330.—[316-17]. Boxes containing cornelian, amber, and lapis-lazuli beads, from Spiti. P. Egerton, Esq.

Lapis-lazuli is called "rust."

The hill tribes are very partial to ornaments made of coral and amber. I once saw near Chamba a woman who wore a long necklace consisting of large smooth lumps of amber strung together in an irregular manner; her husband said the ornament was a family one, but he could not say whence it came.

A man at the same place had a necklace of fine coral, which he said he bought from a merchant who brought it from beyond Kumaon.

LAHORE.

331.—[326]. Series of gems.

The Lahore district exhibited a series, with a view to showing what gems were in use for decorative purposes in the Punjab. Not a few of them come from the Northern Frontier, beyond Kábul, and Kandahár. Hawking merchants are to be often met with offering for sale agates, cornelians, blood-stones, turquoises and garnets, from these places. Some of the

* *See* Cunningham's Ladákh, p. 304

gems are imported from southern parts, such as sapphires, which come from Ceylon,* and rubies and diamonds from Central India, Golconda, &c.

The series are as follows :—

Diamond. (Híra almás.)

Ruby. (Mának.)

Inferior ruby. (Lálri.)

Garnet. (Sang-í-mehtáb. Támbrá.)

Jacynth. (Gulmídak.) A gem owing its deep orange color to the presence of zircon. Gulmídak is a stone very little thought of by native jewellers. The name Támbrá (copper colored) is sometimes applied also to the jacynth.

Imitation Jacynth.

Emerald. (Zamrud. Sabza, panna.)

Sapphire. (Nílam.)

I subjoin an account of some of these gems as showing the native ideas on these subjects :—

Diamonds are esteemed by native jewellers as the first-class of jewels. They are believed by them to be white, yellow, red, green and black ; that the colored ones are extremely rare, but that they are occasionally found of a white color spotted with red, which are rejected as bad.

Diamonds are brought from Golconda in the Dekkan, and from Charna-parna. They are stated to be obtained by washing the soil, a workman pouring out the sand against the sunlight and noting the diamonds by the flash of light. They are classed by jewellers into three kinds—"Hírá ba-rang-i-nausádir" (grayish, or the color of sal-ammoniac) ; "híra makdúni," of paler color ; and "almás-i-hadídi."

Next in rank to diamonds, according to the ideas of native jewellers (and they are correct), come rubies. They must be hard and transparent, "shafáf."

The most esteemed kind is the yákút rumáni, "whose color is like the seed of a pomegranate."

There are inferior kinds of rubies, classed as "lálri," and garnets (támbra, &c.)

They enumerate among rubies the "dúdi" or tánsala, which is a kind of "smoky" cairngorm, and the "náringi," which I suppose to be the jacynth (also called gulmídak), and which English jewellers sometimes erroneously call "cinnamon ruby."

The kinds distinguished by the appellations, "zafráni," and "zard," or phokráj, are pale and dark topazes.

Included as a sort of rubies also, come sapphires, called by the epithets "kábúd," "asmáni," "surmai" (color of antimony, blue-gray.)

Formerly rubies were brought from the Bádakshán mines, which do not now yield. A native jeweller informed me that they came from "Jazíra Pígu," by which he might have meant the Burmah peninsula.

The "blue rubies" (sapphires) come from "Lanka," Ceylon.

Emeralds are less hard than either of the foregoing ; and yet emeralds (all more or less with flaws) are the very commonest kind of jewels, and some of the native princes have emeralds of immense size. I have seen a flat tablet of emerald, full of flaws, but otherwise of good color, nearly 2½ inches square, worn as an amulet, and engraved all over. The Maharaja of Kapurthálla possesses a large oblong emerald of this kind, and the Maharaja of Pattiala has a round emerald of enormous size.

Probably they are imported, some *viâ* Calcutta, Bombay, and the Persian Gulf, and some overland by Yarkand and Herát; though this source is not now so important as it was before the Bombay and Calcutta trade was known, at which time the import trade must have supplied all Northern India ; Central Asia *may* be a source of emeralds ; the *beryl*, of which mineral many of the native stones consist, occurs in the Siberian Altai range; a number of these gems also come from Khatân, Ilchi, and the Chinese provinces.* Natives say they are found in gold mines, and take 20 years to come to perfection. They are called "zamrad," or "zabrjad," and in Panjábi "panna." The most esteemed colors are—the "zabábi," next the "saídi" said to come from the city Saida in Egypt. "Raiháni," *new* emeralds ; "fastíki," old emeralds, (that is, that have completed their 20 years) ; "salki," "zangári" (color of verdigris,) "kirási," and "sábúni." Sometimes emeralds have flaws of intervening talc or sand. It is believed that a fly will not settle on this gem. Most of the emeralds commonly in use, are smooth cut and bored like beads ; they are always full of flaws, and this seems so much the custom that a very good mock emerald which I have is made with flaws —as if sure to be detected otherwise. The flaw is termed, "rag."

Emeralds are very restricted in their localities of production. Pliny says, the best came from Scythia in his time. Mawe on diamonds, quoted by MacCulloch, says that for the last two centuries Peru has been the only country known to yield emeralds. The beryl, no doubt, is found in Siberia, which may have given rise to Pliny's statement.† Still it is difficult to say with certainty where Indian emeralds

* Interesting information about the gems of this island will be found in Sir E. Tennant's work on Ceylon.

* Many gems are imported from Ceylon, where rubies, amethysts, topazes, sapphires, and cinnamon stones in great abundance are found, but not emeralds.

† This confirms to some extent the supposition that many emeralds come from Russia, Siberia, and Central Asia to India.

formerly came from. They are not produced in Central India; and notwithstanding the probability of the North West trade as a source, emeralds are not enumerated in any of the lists of imports; they may however come in those unknown parcels of gems that are imported by Yarkand and the adjacent regions.*

Turquoises are found at Níshápúr, Khujind, Kirmán, at Azirbeján, in the hills near Shiraz, and in the Thibet hills. The best come from Níshápúr, and these are said to be clear of color when the air is clear, and to become dim in cloudy weather; they are called níl bhúm, and lose their color at the smell of musk and tallow. The color of the Kirman turkis, is evanescent. Dealers practise deception by soaking their turkises in water, which makes them look of a darker color than they really are. The Shiraz and Kirmán turkises are of a whitish color, and called shíábúki and shirbhúm (milky.) There is also a coarse kind of turquoise stone found in Thibet, used to ornament saddlery and women's head dress of those parts of the country.

Turquoises are of eight kinds, ranged in order of their excellency:—"Fatahi," "azhari," "sulaimáni," "zánwí," "asmáni," "abd-ul-hamídi," "Indalísi," "kanjinya." The stone is believed to take seven years in coming to perfection. The best existing account of the Níshápúr mines is in "Ferrier's Caravan Journeys;" the book is sufficiently uncommon now, to warrant my extracting the account as it stands. The author writes as follows:—

"These celebrated mines are near the village of Madene, about thirty-two English miles from Nishapoor; the road to it is for the first five miles across a plain of great extent, covered with villages, gardens, well cultivated fields, marvellously productive, owing to the streams which flow from the Banaloo Koh and other mountains near. Approaching these the country changes, and we found ourselves riding through hills of sand and a reddish clay devoid of all vegetation; their sterile appearance was accounted for by the traces of efflorescent salts which were soon seen in large quantities, and would prevent any cultivation.

"Salt abounds in this locality, and we passed the principal mine, Dooletaly, about six miles from Madene. This is an enormous rock, covered on its exterior surface with a thin layer of red clay similar to that I have mentioned.

"Nothing can be imagined more simple than the mode of working out the salt—the miner's mattock is the only instrument used. These mines are the property of the Government, who lease to the highest bidder; at present the rent is only 150 tomauns yearly. A good workman can extract about 800 lbs. a day. The salt is beautifully white and of a fine grain.

"The road which led to the turquoise mines, the principal object of our excursion, ran through some high and naked rocks, which by their dark colour seemed to be porphyry; I think, however, they were of a compact calcareous nature, strongly stained, as I did not see any rocks of another system. At their highest elevation they had a metallic appearance, which made me think that iron was the coloring matter; but not being sufficiently learned in the geology, I could not positively determine this. In the middle of this rocky and broken ground we came at length in sight of two villages, one on the crest of a hill, the other in a pretty valley. Beneath, they were fortified by a loop-holed wall and inhabited by about 150 families, who emigrated here from Badakshan, under the protection of one of the last Persian Kings. These colonists speak bad Persian, and have quite forgotten their own language; they show considerable tact and intelligence in working the mines.

"The turquoises are divided into two classes according to the positions in which they are found. The first called sangai or stony, or those which are incrusted in the matrix, and which must be removed by a blow of the pick or hammer. The second are found in washing the alluvial deposits, and are called *khaki* or earthy; the former are of a deep blue, the latter though larger, from being paler and spotted with white, are of less value. If we are to believe the miners, no turquoises have been found except in this group of rocks. The Persian Government never makes any explorations on its own account, and is content to lease the mines at an annual rent of five hundred tomauns. I understood that the most valuable stones are found amongst the debris of the old working, and at the bottom of shafts long since abandoned. Excavations have been made one above the other, but for the most part near the base of the mountains.

"Here are to be seen galleries, tunnels, and shafts, the largest of which are thus designated: Abdoorryzak, Sharperdar, Kharydji, Kemeri, Khaki and Goorsefid.

"Having given a largesse to the miners to strike a few blows with their picks in honor of the happy planet of the traveller, Be-talei-saheb, we were permitted to enter the first of these mines to witness the operations. These were simple enough; the mattock was again the only instrument, but it was very skilfully used, and when a layer of rock was

* MR. BOILEAU, who was appointed a few years ago to appraise the jewels in the Governor General's Toshakhana, mentioned the import from Yarkand as a fact.

detached, great precautions were taken to remove it without disturbing the turquoises which might be met with. These are not found in the hollow of an eagle-stone like the amethyst, but are seen as if incrusted or glued in the matrix, to the number of from twenty-five to thirty, and more or less near one another. Each of these stones is enveloped in a thin calcareous covering white on the side adhering next to the turquoise, but brown on that next to the matrix. How is it that the coloring substance has stopped precisely at the exterior, and that it has not injured the purity of the turquoise ?. But I will rather relate what I saw, and not undertake to explain. I will simply state that one finds on the side of this very mountain, Benaloo Koh, indications of the carbonates of copper, both blue and green, as are the best varieties of malachite.

"We were not very successful in our researches, but the best turquoises are found, with the exception, I have before stated in this mine, Abdoorryzak ; those of Kharyji follow.

"We next examined the washings of the Valley. These are to the south of the village. The rock is not met with here, and the soil is composed of clay, gravel, sand and rounded stones, evidently an alluvial deposit. Here I was again obliged to try the influence of my planet, after which several sieves were filled with the soil and gravel in question taken from a shaft just opened ; these were carried to a running stream close at hand and the earthy substances washed from them, and the stones being turned over, the turquoises were soon recognised by their azure tint. Of these we found a pretty good number, and of fair size, but they were unfortunately of a pale color, and therefore of little value. The workmen called them by the name of "Taze Madene," or of the new mine, to distinguish them from those of a deeper color found in the old workings.

"These worthies affirmed the turquoises are similar to cherries, inasmuch as both one and the other acquire their color as they ripen ; and they added that although the cherry comes to perfect maturity in one season by the vivifying rays of the sun, a turquoise requires a thousand to obtain the same result. The miners here do not enjoy a great reputation for honesty, and very fine turquoises are said to take their way to Nishapoor instead of into the pockets of the owners of the mines, being sometimes transferred for a consideration to parties who visit the mines. But here the uninitiated may be taken in, for the miners keep them for some time in a wet cloth which deepens their color, and the purchaser does not find how pale the stone is until he has parted with his money. I was informed that turquoises of immense size are sometimes found in the washings. Futteh Allee Shah, the predecessor of the present monarch, had one made into a drinking cup, and it is well known that there was a turquoise in the Treasury of Venice which weighed several pounds. A nobleman's harness in Khorassan is frequently ornamented with small turquoises, but these are of course of comparatively little value."

Continuing the list of gems sent by the Lahore district we come to—

"Tánsala." Smoky Cairngorm.

Topaz. "Phokráj."

Cat's-eye. "Lasniyáń."

Turkis. "Firozah."

Imitation do. (Very commonly used).

Bloodstone. "Sang-i-pattauni."

Lapis lazuli. "Lájward" from Kandahár. It comes also from Bukhára, Persia, and Central Asia.

Cut Agates. "Manka," brought from Kandahár and Kábul.

White and red cornelians. "Ghori," do.

Onyx. "Sang-i-Sulaimán" do.

"Yamní," a kind of "pebble," from Hindústán.

Avanturine. "Sang-i-sitára," (from its star-like glitter of particles).

Coral red. "Gullí." Bekh-i-marján.

Mother-o'-pearl. Nimrú.

Pearl. "Moti," "Lúlú," "Marwaríd."

Pearls are imported either from Ceylon and Japan, or from the Persian Gulf at Bahrein.

"The pearls taken at Bahrein, though not so white as those of Ceylon and Japan, are much larger than those of the former place, and of a more regular shape than those of the latter. They are of a yellowish cast, but have this recommendation, that they preserve their golden hue ; whereas the whiter kind lose much of their lustre by keeping, particularly in hot countries. The shell of both these species which is known by the name of mother-o'-pearl, is used in Asia for various purposes.

"The annual revenue arising from the fishery in the latitude of Bahrein is computed at 3,600,000 livres (£157,500). The greatest part of the pearls that are uneven are carried to Constantinople, and other ports of Turkey, where the larger compose part of the ornaments of the headdress, and the smaller are used in works of embroidery. The perfect pearls are reserved for Surat, from whence they are distributed throughout all Hindoostan. In 1824, pearls to the value of 1,200,000 German crowns were imported into India from Bahrein."*

The foregoing are the only gems ever met with ; but pearls, emeralds, turquoises, rubies and diamonds

* This information is derived from several parts of the volume in the Bombay Selections, entitled "The Persian Gulf."

are the commonest in native jewelry. Most of these jewels have some fancied medicinal or talismanic virtue, and to this day, elixirs made of jewels reduced to powder are administered, and pearls are also supposed to act medicinally. A ruby worn on the finger is supposed to protect the wearer from nightmares in his sleep and from evil dreams.

There is a kind of ornament worn on the arm, called a "nau ratn," the "nine gems," which indicates the only jewels that are esteemed as precious, they are—Diamond, ruby, emerald, sapphire, topaz, pearls, coral, turkis, tansala. The others, and also the agates, blood-stone, &c., are mostly in use for signet rings, in the art of engraving which natives are extremly skilful.

The Report of the Jury now follows:—

REPORT ON MINERAL PRODUCTS.

SECTION A. CLASS I.

DIVISIONS I. AND II.

JURY.

DR. BROWN, *Chemical Examiner*,	MR. J. E. GORDON,
MR. PURDON,	KUNHYA LALL,
DR. GRAY,	MAHOMED SULTAN,
MR. BAINES,	MR. STONE.
MR. GORDON,	COLONEL SIM.

REPORTER—MR F. DREW.

The objects contained in this class are the products of the earth itself which are brought into use either in the state in which they are found, as colored earths, talc, slates, building stones, &c., or are rendered useful after peculiar treatment, such as metals obtained by smelting, or lime and plaster of Paris obtained by calcination. The other great class of mineral products is occupied by those substances, distinguished by the appellation "chemical substances," which are obtained from various minerals, earths, &c., after undergoing chemical processes of sublimation, distillation, solution, &c., &c. It is with the objects in the first class only that the present Report deals. It includes also a notice of the fossil collection, but without considering that subject in a palæontologic point of view, which properly belongs to a different branch altogether. A classified list of the various kinds of articles will be given below, and afterwards the specimens will be described, so as to show the value or importance of the mineral wealth of each District of the Punjab, and what use has hitherto been made of it.

The metals are Iron, Copper, Lead, Antimony, Gold and Manganese.

Then follow Building stones, Sandstones, Limestones, Marbles, Hydromagnesite, Agates, Lapis-lazuli, Precious Stones, Slates, Elastic Sandstone. Mica or Talc, Gypsum, Selenite, Fire clay, Porcelain clay and Pottery clays, Glass-sand, Sulphur, Plumbago, Millstone, Whetstone, Corundum, Petroleum.

Yellow earth, Red earth, Fuller's earth, Múltáni mitti, &c., several Clays and White Washes, Coal lignite, Fossils.

These products are now considered in detail:—

METALS AND METALLIC COMPOUNDS.

IRON.

From Gurgaon there is a specimen of a good rich iron ore, the hydrous peroxide of iron.

There are specimens of magnetic iron sand (that is, sand composed of small particles of magnetic oxide of iron) from two or three places in the Simla District, from Suket and Mandi, and from six or eight localities in the Kangra District, and from these too is a piece of schistose rock containing the magnetic iron ore in minute crystals; this being the kind of rock from which the iron sand was originally derived.

From the Kot Kandi Mines in Kangra is some very good hæmatite iron ore (No. 231). From Chamba are one or two specimens of good iron ore, and others that are poorer.

From the Kashmír territory is a piece of massive magnetic oxide of iron or lodestone, and some siliceous iron stone from a bed of it found in Kashmír proper.

From the Wazírí hills there is a brown iron ore that is pretty good; and there is a very rich red hæmatite from Bakot in the Hazara district. Besides the ores there are specimens of the iron made at Rampúr on the Sutlej, from Suket and Mandi, and from the several places in the Kangra district; from one of these, the Bhir Bangál mines, is the piece (No. 214) for which the prize for the best specimen of native iron is awarded; this, like most of the others, is smelted from a fine magnetic iron sand; and Mr. Baines, of the Punjab Railway Department, reports that the iron has been forged and proves to be of most excellent quality. Nos. 363 and 364 are also good iron; they were produced in Kangra, but are now exhibited from the Lahore Museum. From the Wazírí hills and from Bajún in the Dera Ismael Khán district, is some iron that is tolerable good, and the same from Bajaur north of Peshawur, but there is no specimen of the best iron of that place. From this it appears that almost in every hilly region around the Punjab there is iron ore and in most of them ore of good quality; the reasons that the manufacture of iron has not been carried out to a greater extent to meet the late greater demand, are that coal is not found near the iron ore as in most cases in England, and that from want of knowledge the smelting with charcoal is carried on in such a way that not nearly as much result is produced as might be.*

COPPER.

From Gurgaon, there is a piece of copper pyrites, which is a usual ore of this metal. There are specimens of good copper ore (No. 155) from the Hissar district and of the metal got from it; from Pelang in Kúlú and from Manikarn near Kúlú, in the Kangra district, is some copper pyrites, and there is blue carbonate of Copper from Spiti. From Rondu, 16 marches beyond Kashmír, is copper glance, another kind of ore.

Of artificial compounds, there is acetate of copper crystallized and sulphate of copper (blue vitriol) from Amritsar, and blue vitriol again from Hissar.

On the whole, the specimens of the ore of this metal are but poor, but their presence in several different parts is proved.

LEAD.

The common ore of lead is galena, the sulphide; it is found at Rupi of Kúlú, in the Kangra district, associated with quartz, and there are some small fragments of it (No. 904); from Khagúla in the Shahpúr district; besides these there are only a specimen from the Kashmír country and one from Kandahár.

* For want of competing specimens the prize for native steel offered by the Railway Company has not been awarded.

ANTIMONY.

There is sulphide of antimony found at Jaggatsukh Kúlú, in the Kangra district, and two specimens are sent from Spiti; from Bajaur is some of the same, the price of which is given as Rs. 12 per maund.

Besides these there are four good specimens from the Lahore Museum, but there is no record of where they were dug.* It would seem that there is enough of good antimony ore in various parts; but as it is here only used as a cosmetic, &c., and not in making alloys; it is not worked in any great quantity.

MANGANESE.

There is pyrolusite or oxide of manganese (used in glass-making) from the Kashmír territory.

GOLD.

In the great gold-mining countries there are three ways in which gold occurs,—in the solid rock, in nuggets, in gravel, clay, &c., and in the form of gold-dust mingled with the sands of the rivers; in the Punjab it is only in the last, the least productive form that is found, but in this form it is met with in the sands of almost all the five Punjab rivers.† The specimens sent are—ore from Karrar on the Markanda river in the Amballa district; one from Spiti; one (No. 235) from the Beyás near Haripúr in Kangra district, (to which a prize is awarded), this sand being of more than usually coarse grains; and one from Lahaul. Then there are some from the Jhilam river, for one of which (No. 460) from Kas Gabhir in the Jhilam district a prize is given; it is gold of a good color and is in pretty large grains. From the Indus also both from Attock and Hazara there are specimens of gold-dust.

BUILDING MATERIALS.

STONE OF VARIOUS SORTS.

From Sahi Balabgarh, in the Delhi district, there is a good collection of building materials, which includes the red, the spotted and the light-colored sandstone, so much used in the large buildings of Hindústán; and from the same place are polished blocks of white marble, and of a pretty dappled gray marble (called Narnaul marble), which last is also exhibited from the Hissar district.

From the Kangra district there are gray limestone, sandstone of two sorts, both good for building, and granite. Sent from Madhopore, is some nice workable sandstone which must come from the hills, above that place. From Kashmír there is some black marble and some polished slabs of serpentine, which is found at Tashgám in little Thibet.

From the Salt range (Jhilam and Shahpúr districts) there are good building stones, sandstone and calcareous sandstone; from Jhilam are specimens of marble which might become useful for building, among this series must be counted the gypsum or alabaster of the same hills (sometimes wrongly labelled soapstone, or marble (Nos. 468 and 469). The harder varieties of this might be used for interior decorations while the general run is fit

* These specimens are of Himálayan prooduction.—B. P.

† I have never seen gold from the Rávi. The natives say it is never found there.—B. P.

for making plaster of Paris, of which there is one specimen (No. 515*) from Shahpúr. From Dera Ismael Khán, there is only some soft white limestone, from Kuhát a cellular limestone used in rubble masonry, while from Attock are two or three kinds of stone, calcareous sandstone, a variegated limestone, granite and sienite; lastly, there is yellow marble from Peshawur, and argillaceous limestone from Abbottabad.

ZAHR-I-MOHRA.

A stone (No. 611) called by this name, but which scientifically is hydromagnesite, a compound of magnesia, is dug near Skardo in Baltístán, and there cut and turned into cups, plates, &c., it is supposed to have a wholesome effect on any fluid put into it and to break should poison touch it, one kind of zahr-i-mohra, called Khatai, or "Chinese,"—is much valued by natives as a medicine, they grind the stone into a fine powder with water and swallow it.

SLATE.

From Gurgaon, there is moderately good slate. There is some also from the Simla district. From the Kangra and Dalhousie hills, there are many specimens of slate, some of them very fine ones, which show that there is a supply of good roofing material, the use of which may extend to wherever the expense of carriage does not hinder it. There is one slate from Dalhousie 12 feet long and 4 or 5 feet wide; there is another with a particularly nice grain, it looks like marble. From the Kangra district are two slates with Tibetan inscriptions carved on them. Again there are slates from Attock and from Abbotabad. Among stones used for roofing purposes appears the sang-i-larzan, or

ELASTIC STONE.

This is a sandstone that has the wonderful quality of flexibility to a considerable degree; it is sent from Kalyána hill in Dádri, now part of the territory of Jhínd. The districts of Hissar, Jhínd and Rohtak, all exhibit samples from this locality. The specimen from Rohtak is a fine one, 2½ feet in length.

LIME.

In all the districts that are all hilly, limestone is found, as Gurgaon, Simla, Hushyarpúr, Kangra, Jhilam, Pindi, the Deraját, &c.; in the plains its place is somewhat supplied by kankar, of which there are specimens from six districts, and it probably exists in more.

CEMENT STONE.

A rock, half lime half argillaceous, from Dugshai district, with specimens to show its application Nos. 206, 207 and 208.

MICA OR TALC.

Is used in building, being first pounded and mixed up with the lime, &c., in making chunam, which thus acquires a glittering appearance: some lump plaster of mica used for

* The sample proves on analysis to be common lime, but from the description accompanying it, it is reasonable to suppose that plaster of Paris is made in the district by burning gypsum. Just as it is at Batri in the Dalhousie hills.—B. P.

this purpose are sent from Delhi and Gurgaon, and there is also some from the Kangra district and other places.

SELENITE OR CRYSTALLIZED GYPSUM.

A mineral that is often mistaken for talc and for other substances; it is in clear white crystals that are rather flaky; there is some from Murree, from Dera Ghází Khán, and other places.

SUBSTANCES USED IN MANUFACTURES.

FIRE-CLAY.

This substance, so useful for crucibles and furnaces, is only sent from two places, Kafir Kót in the Shahpúr district, and Bánihál in Kashmír.

POTTERY AND PORCELAIN CLAY.

There is pretty fine clay for ordinary pottery sent from several districts, but the desideratum is a kaolin from which purely white porcelain can be made. Some sent under that name from Lahaul is only very fine sand, and quite untenacious; some from Dalhousie has been used in the Central Jail, but it is found that it colors slightly on baking; there is a specimen from Delhi that is pretty white, but has fragments of mica mixed with it. Therefore the prize offered for the best porcelain clay cannot be awarded.

SAND FOR GLASS-MAKING.

The only samples from Gurgaon. It is a coarse earth abounding in the alkaline efflorescence so abundant in many parts of the country: this sand is melted just in the state in which it is found, as it contains the alkali naturally. The result is the coarse green "kach," or semi-transparent glass which accompanies the sample.

SULPHUR.

Sulphur, somewhat mixed with impurities, is exhibited from the Murree hills, from the Sulaimán hills near Dera Ismail Khán, and from Kálábágh. From Ladákh there is a purer specimen.

PLUMBAGO OR BLACK LEAD.

There is a powdery plumbago from the Jammú territory, and a specimen of rather better stuff found in some other parts of the Gurgaon hills, and sent from the Lahore Museum.* Nos. 376 and 378 are a mixture of shale and plumbago, they make a pretty good mark on paper; No. 376 is a schist, probably a talcose schist, which might also be used for drawing; but no one of the specimens sent are of that fine and sectile black lead that is required to make pencils of. There are some samples from Gurgaon approaching in nature to plumbago. One of these, No. 182, contains sample of the material cut up with little cubes; it does not appear to have much of the polishy appearance of black lead, but makes

* These samples were unfortunately not marked, but it is highly probable that they come from Gurgaon near Sonah, and that they were sent up with the report on plumbago of the Mewatti hills, an abstract of which will be found under the head of Plumbago. A drawing, which was executed with points cut from the plumbago, was sent to the Exhibition to illustrate how far the plumbago was likely to be useful for the purposes of pencil making.—B. P.

a soft gray mark more like drawing crayon, for which purpose it probably would answer very well.

MILLSTONE.

There are two kinds of millstone sent: quartz rock from Dádrí, in the Hissar district; and a schist, with nobs or lumps of quartz in it, from Palandurah, in the Peshawur district.

WHETSTONE.

Is sent from Panjtar, in the Peshawur district.

CORUNDUM.

Comes from Nílah, in the Peshawur district (No. 586), where it is priced at Rs. 13 per maund, and from Dádrí, in the Hissar district (No. 159). It is used in cutting and polishing stones.

PETROLEUM, OR MINERAL PITCH.

There is a specimen (called momyai) from Ladákh, it is sold at one tolah for 9 annas; and there is some brought by Dr. Cleghorn from Lahaul, where it is found oozing out of the ground in three or four places. There is also a specimen of liquid petroleum, and of oil distilled from it, from the Rawulpindi district; and in some parts of the Salt range this mineral also occurs. It is used as an ointment.

ASBESTOS.

A fibrous silky mineral found in veins in rocks; there is a specimen of soft asbestos from Bunnoo, and another (locality unknown) that has a harder and stiffer, but still fine fibre.

SUBSTANCES USED AS DYES, &c.

YELLOW EARTH.

There are yellow clays or ochres from Gurgaon, Haripúr in Kangra district, Lahore, Kheura, in the Jhilam district, and Márí, in the Shahpúr district.

MULTANI MITTI.

That sold in the bazars is a lamellar hard yellow ochre used in dyeing, but under the same name are sent specimens approaching in nature to fuller's earth, and called *sabz mitti* or *khajrú*, sent from Dera Ismail Khán and Dera Ghází Khán districts.

FULLER'S EARTH.

From Yárú, Dera Ghází Khán district (No. 456), and from Rawalpindi.

RED EARTH.

There are orange colored and red earths used as dyes, from Spiti.

There are red clay and red ochre from the Simlah district, from Chamba, Haripúr in Kangra, Lahore, Rawalpindi, Bhalla in Jhilam, and the Deraját, Kohát and Yusafzai. Among these is the well known *harmuzi*, an earth of deep chocolate red color.

There is some fine colored powder exhibited from Lahore, as lapis lazuli. It is imported from Europe, being the artificial or prepared kind; it sells at Rs. 4 a seer.

FUEL.

Every specimen, in the Exhibition, of what is called *coal* is, with perhaps one exception, really *lignite*, a substance half way in structure between wood and coal; this is found in many parts of the hills, usually in detached pieces in the rock,—the remains of some tree that got buried in the sand and mud when the strata were being formed; but now and then the lignite is in a more or less continuous layer, in which case it has been made by the growth of plants of various kinds at that very spot.

There is lignite from Biláspúr, and from different places in the Kangra district (No. 241-244); some pretty good lignite from near Kotli in the Kashmír territory, where it occurs in a bed 15 or 18 inches thick; from Kundal mountain, Jhilam district, is some coal, approaching to Cannel coal (No. 463); one or two specimens are sent from Kálábágh, and some from the Sulaímán hills, on the frontier of the Dera Ghází Khán district. Of the coal lately brought into Lahore from near Pind Dádan Khán, there is not a specimen in the Exhibition (unless No. 463 be from the same bed), but it may be as well to mention it here, as it is more like a true coal, and more promising as a useful fuel than any other yet found in the Punjab.

ORNAMENTAL AND PRECIOUS STONES.

The best of the precious stones, being mounted, are reckoned in another Section of the Exhibition, so there is little to be said about them here. There are some beautifully complete and perfect crystals of quartz in the form of a double hexagonal pyramid and a double pyramid with prism from Kathá in the Sháhpúr, and Kúsak in the Jhilam district; they occur imbedded in the salt gypsum.

Dittú, a goldsmith of Lahore, exhibits a box of stones, among which the sapphires and the light rubies, though of no great size, deserve mention, and there is a rather large colorless topaz.

From Bombay is a case of Cambay pebbles, agates, &c., worked into various fancy articles, of which the best (and these are really good) are, a white cornelian necklace, a long paper-knife, and a watch-stand of agate, a cup, and saucer in agate, and one in jasper, and some knife-handles of the same stones.

MISCELLANEOUS.

FOSSILS.

It does not come within the scope of this Report to give a palæontological description of the Fossils sent, but it is well to record the localities they come from. The finest collection has been made and exhibited by Dr. Costello from the Shaikh Budín hills, in the Bunnoo district; it consists chiefly of remains of mammalia, but these also are shells from the older rocks. From Sirmúr are some fossil elephant's teeth, and from other places in the Siválik hills (especially Núrpúr in the Kangra district) are mammalian bones. From Spiti are several specimens of ammonites and of bivalves; and there are some fossils from Bunnoo and from Dera Ghází Khán. Several that were in the Exhibition are not mentioned here, because there was nothing to show their locality.

The Jury awarded the PRIZES allotted to them as follows :—

A prize of Rs. 60, given by Mr. Arratoon, for the best sample of gold-dust from the rivers of the Punjab, is awarded—

Half to the TAHSILDAR OF TALAGANJ, for gold dust from Khass Gabhír, Jhilam district (No. 460);

Half to LOCAL EXHIBITION COMMITTEE, Kangra, for gold sand and gold from near Haripúr on the Biyás, Kangra district (No. 235.)

A prize of Rs. 50 given by the Punjab Railway Company, for the best specimen of iron produced in the Punjab, is awarded to—

LOCAL EXHIBITION COMMITEE, Kangra, for iron produced at the Bír Bhangál mines, Kangra district (No. 214.)

The Jury also awarded HONORABLE MENTION to the following :—

Collection of Fossils from Shaikh Budín hills, Bunnoo districts (No 17 to 100), exhibited by C. COSTELLO, ESQ., Assistant Surgeon, 6th Punjab Infantry.

Collection of Building Materials used at Delhi, from Sahi Ballabghar, Delhi district, (Nos. 2 to 13) exhibited by C. J. CAMPBELL, ESQ., Executive Engineer.

Slates from Dalhousie (Nos. 336 to 345), exhibited by MAJOR BLAIR REID.

Salt from Kathá, Kheura, and other mines in the Salt range, Shahpúr district (Nos. 504 to 507), exhibited by Mr. CHILL and MR. W. MATHEWS.

F. DREW,
Reporter to the Jury.

N.B.—The special prizes for porcelain clay and native steel were not awarded.—B. P.

Division III.—Chemical Substances used in Manufactures.

SUB-CLASS (A). MINERAL ACIDS.

THE method of preparing the acids is as yet an imperfect one, and the manufacture is conducted on a small scale, only in the large cities such as Lahore, Amritsar, &c.; there is a factory also in Kashmír. The price at which these acids are turned out is high compared with the prices current of Europe. It will be long before we can obtain here sulphuric acid even of an inferior quality at 3*d.* a lb., as we can at home. The acids principally made, are sulphuric, nitric of two kinds, and hydrochloric. Sulphuric is made in leaden chambers, as at home, only on a smaller scale. At Lahore, where the manufacturer is a very intelligent and progressive man, the samples produced are very fair, and likely continually to improve. The manufacturer is importing a platinum retort, to concentrate his acids.

332.—[888]. "Tezáb gandhak," sulphuric acid, made and exhibited by MUHAMMAD ISMAIL BASHI. City of Lahore.

Lahore Collection.

Sulphur is burnt and the fumes of the sulphurous acid gas are passed into a leaden chamber with steam and nitric acid; the acid as it forms, is drawn off by a leaden pipe at the bottom of the chamber. It is then evaporated in leaden vessels till white fumes begin to be given off. It is subsequently concentrated in a platinum retort.

333.—[889]. "Tezáb shora," nitric acid (by the same maker.)

This is nitric acid prepared by treating sulphuric acid with nitrate of potash, as in Europe.

334.—[890]. Tezáb shora-wa-kahi, nitric acid mixed with hydrochloric (by the same maker).

This is another kind of nitric, or rather mixed acid, which is much cheaper than the last mentioned. It is obtained by distilling "kahi," the impure protosulphate of iron and alumina with nitre (shora). The nitre contains a quantity of chloride of sodium, and hence in distillation, hydrochloric acid is formed along with the nitric. The nitric acid is much used in fining gold from an alloy of silver, by what is called the process of quartation. If pure nitric acid is used, the alloy is digested for some time till the acid has dissolved the silver, leaving the gold in a spongy mass of particles. The solution of silver is then precipitated with common salt; forming chloride of silver.

From this substance the metallic silver is recovered by the hydrogen evolved on mixing it with zinc scrapings and dilute sulphuric acid. If the mixed kind of acid is employed, it is necessary first to remove the chloric acid from the nitric, which is done by adding nitrate of silver in solution, as long as any precipitate falls. The result obtained is pure nitric acid and chloride of silver. These are separated; the nitric acid is used as before described, and the chloride of silver may be reduced along with that formed in the second part of the process.

335.—[890]. "Tezáb nimak," hydrochloric acid.

This is usually made by pouring sulphuric acid on culinary salt in a still, and applying heat till the acid passes over into a receiver. Lately it has been made by heating the substance which remains after the preparation of nitric acid, with common salt. If the nitric acid be made by the first process above mentioned (No. 327), the residue is chiefly bisulphate of potash; but if the nitric acid has been prepared from nitre and "kahi" (No. 329), the residue consists partly of bisulphate of potash and partly of sesquioxide of iron, and in that case the residue requires to be purified by solution and filtration before being used to make the hydrochloric acid.

336. Acetic acid, "sirke-ká-tezáb" is not represented in the collection though it

has been prepared at Lahore by MUHAMMAD ISMAIL, the manufacturer who produced the other samples.

There are several varieties of acetic acid. It can be distilled from vinegar, but the common country vinegar of the bazar generally contains only a very small portion of acetic acid, often not more than 2 per cent. If 10 measures be taken of vinegar, it should be distilled till 9 have passed over.

A variety of pyroligneous acid is produced by the distillation of chips of wood in an iron retort, provided with a bent tube leading to a receiver. Some kinds of wood answer better than others. In Bengal the jainti *(Æschynomene)* is employed; experiment would determine which in the Punjab is the best. The product of the distillation is allowed to settle 24 hours, and the acid separated from the oily matters, and again distilled. Either of these acids may be converted into pure acetic acid by adding "sajji lota" (the better kind of carbonate of soda, not the black kind) till all effervescence ceases. The mixture is allowed to settle, after which it is poured off and evaporated till crystallization begins. Collect the crystals when the mixture is cold and again heat them very gradually, stirring all the while, when an odour of acetic acid will be perceptible. The crystals are acetate of soda. Take any quantity of this salt and pour over it double its weight of strong sulphuric acid in a glass retort, and distil on a sand bath nearly to dryness. The receiver should be cooled by saltpetre. The distilled liquor is to be shaken up with a little red oxide of lead (sandúr), and when the powder has subsided, it should be decanted and re-distilled, and pure acetic acid will be the result.

In England, instead of carbonate of soda, they use lime and then decompose the resulting acetate of lime by sulphate of soda, and so produce acetate of soda.

This process was followed at Lahore, but the carbonate of soda being ready in every bazar and very cheap, it is simpler to use it at once.

"In Germany," says O'Shaughnessy* "a strong acetic acid is obtained cheaply and rapidly by causing a mixture of one part spirit, four parts water, and about $\frac{1}{1000}$th part of honey or yeast to filter into a cask containing wood shavings and provided with holes to secure a free circulation of air. The fluid drops into the cask containing the shavings, and should be repassed over the shavings four times. The action is most effective when the temperature ranges from 75° to 100°." The cask to contain the shavings should be provided with a tray above to receive the liquor, the tray is perforated with small holes stopped with cotton wicks to moderate the flow and furnished with larger holes for ventilation, which are filled with glass tubes rising above the level of the liquor to prevent it flowing down them.

337.—[4411]. Sulphuric acid, locally, called "Feroki."
Dera Ghazi Khan Sample. TAHSILDAR OF DERA GHAZI KHAN.

* Bengal Pharmacopeia, p. 233.

SUB-CLASS (B.) MINERAL SUBSTANCES USED FOR DYES AND COLORS.

For the sake of clearness of classification the manufactured or artifical dyes and colors are separated from the natural ones which form the large class of earths, ochres, and clays, —and which are employed in manufactures in the same state as they are found. The ochres and earths are included in Division II., at page 22. The Mineral Kingdom does not, in the native system of dyeing, play nearly so important a part as the vegetable; the red dye from "gerú;" an ochre yellow dye,—and the beautiful but utterly unstable ultramarine dye, are almost the only ones in use. The Mineral Kingdom furnishes, however, iron salts and alum, which are indispensable in dyeing operations, though not themselves dyes. Notice of these is taken under the sub-class "Salts."

Artist colors, as well as those prepared for the wood turner, the enamel worker, and the house painter, are mainly supplied from the Mineral Kingdom. Most vegetable colors have too little body or permanency for native artists' colors, (though to this rule there are a few notable exceptions,) and for the purposes of the other trades, the vegetable colors are generally incapable of combination with the vitreous or resinous vehicles employed in applying them to the work.

ARTIFICIAL MINERAL COLORS AND DYES.

The following series was exhibited by Ghulam Mahbub Subhani.

338.—[4574]. "Nílsafá" or "níl wilayíti."

Lahore Collection.

This is not indigo as its name would indicate, but lumps of the ordinary prussian blue (prussiate of iron), probably imported from Europe. Value, Rs. 2-8 a seer.

339.—[5577]. Lamp black. "siyahi."

This is used also for writing ink. It consists of fine soot collected in a vessel held over a burning lamp. The soot is mixed with gum and caked, and the cakes are then sliced up into little shavings. The best black comes from Hindústán, and is valued at Rs. 2 a seer.

This ink is frequently adulterated by mixing with the lamp-black, powdered charcoal, made by burning almond shells.

340.—[4578]. "Ceruse," or white lead, "*safeda*" (carbonate of lead), used as white paint. Value Rs. 1-2 per seer.

It is largely imported from Europe, but comes also from Káshgár. In the bazar there are two qualities, one almost pure ceruse, and sells at 35 Rs. a maund; the other mixed largely with lime and whiteing, sells at Rs. 10; the latter is known by its lightness and by the dirty color it gives when employed as a paint.

341.—[4579]. "Shingarf," cinnabar (sulphide of mercury).

This is imported from Europe, but is said to be found native, in Central India, and also in some parts of the Thibetán mountains in crystalline masses. It is easily ground to a fine powder. The color is beautiful but not very permanent. It values Rs. 2-12 a seer.

342.—[4581-2]. "Hartál," or orpiment (sulphuret of arsenic).

Two varieties occur; the "hartál wilayíti" and "hartál warki," the last so called from its beautiful glittering lamellar texture, value Rs. 0-12-0 and 1-2-0 a seer. The difference is in the shades of yellow they yield; both are sulphurets of arsenic. This mineral is also found native in parts of India. Under the head of Peshawur specimens will be observed an orpiment which comes from the hills north of Swat.

343.—[4583]. "**Wilayíti peori.**"

This is a chromate of lead, or precipitate produced by the addition of bichromate of potash to a solution of acetate of lead. It is the chrome yellow of artists' colormen. It is called "peori," from its resemblance to the "hardwárí peori," or Indian yellow.

344.—[4586]. Sandhúr.

This is a red oxide of lead and is brought from Hindústán,* and also from Europe. It sells for 7 annas a seer, is used largely in painting and decoration. Hindús often use it for religious purposes, making marks with it on their idols, &c., or putting it on their rupees at certain seasons for good luck. It is not unusual in the hills to see a boulder or other stone marked with a patch of red lead, which has been done to convert it into a "devi" or object of worship.

345.—"**Lájward,**" **artificial ultramarine. Value Rs. 4 a seer.**

There is also exhibited with it a sample of *genuine* ultramarine by the illuminator, IMAM WAIRDI, which he says is now rare; but this appears to be either an ultramarine ash, or else to be much mixed with white paint, as it is a pale light blue. It is uncommon, and before the introduction of the European artificial lájward (of which a description is given subsequently, under the Peshawur sample) was sold for many rupees a tolah. In England ultramarine costs £5 or more per ounce.

346.—"**Zangár,**" **verdigris, sub-acetate of copper.**

When pounded yields a green or blue green of great beauty.

Amritsar Collection. **Samples of colors were also sent from Amritsar, the Local Committee of which city exhibited the following, in addition to many of the kinds just described.**

347.—[4516]. "**Sang sabz.**"

This is the green earth of mineralogists,—a silicate of protoxide of iron.

348.—[ ]. "**Kahi surkh,**" **bichromate of potash imported from Europe.**

349.—[4563]. **Color sticks, for lacquer ware.**

These are used by the Kharátí, or wood-turner, to color his ware when the turning process is complete. The sticks consist of shell lac melted down with a certain proportion of wax and sulphur, and colored by various simple or compound colors. They are applied by the hand. The operator holds the color stick against the turned wood object while revolving rapidly; the heat produced by the friction melts the lac and the color is deposited on the surface of the wood. The skill and fancy of the operator directs him either in laying in a uniform layer of color, or else putting it on in little spots or touches, by allowing the color stick only very lightly to touch the revolving wood, thus producing either a smooth uniform color or the pretty mottled appearance so often observed in lacquered ware. Two or three different color sticks are often applied giving the whole a marbled and variegated appearance of great beauty. The color thus applied is spread, fixed, and polished by pressing the edge of a piece of bamboo wood, cut to a flat clean edge, against the turned object while revolving. The final polish is given by a rag with a little oil. The principal colors—are lac-crimson, orpiment, red lead, green, (made of orpiment and prussian blue,) dark blue (indigo or prussian), black, white, brown (or gold color), light blue (or ultramarine).

350.—[4567—70]. **Series of enamel colors.** LALA RATN CHAND.

These are vitreous masses employed by the "mínákár," or enameller on silver, &c. The colors are principally green and blue,—salts of iron and copper—diffused through vitreous matter; a yellowish color also is produced by litharge. In the class "works in the precious metals" will be seen examples of the manufacture, which consists in taking a silver or metal vase, having the pattern of leaves or flowers worked on it in relief and filling the hollows with enamel in a melted state. The colors exhibited are blue, green, and red. Only two persons in Lahore possess the art of making this material; it is made also at Múltán and other places.

Peshawur Collection. **351.**—[577]. **Lapis lazuli, "lájward," priced at 10 Rs. a tolah; is said to be brought from Central Asia.**

Lapis lazuli is also brought from China, Persia, and Bukhárá and from the province of Badákshán, where there are mines of the mineral. In order to manufacture the powdered color, the stones containing the crude mineral are heated red hot and then flung into water to make them easily pulverizable. They are next ground and mixed with a varnish of resin, wax and linseed oil; the mixture is put into a

* It can be made by very carefully and gently oxidizing pure metallic lead while melted in the crucible. A gentle stream of air is blown on to the fused surface, and the process stopped to a nicety, or else the whole is spoiled.

cloth and kneaded with hot water. The first washing is thrown away, and when fresh water is added the fine blue powder is washed out and falls to the bottom; subsequent washings give tints less valuable. In Europe the refuse, after the extraction of the blue, is calcined and yields a series of delicate gray tones known to artists as "ultramarine ash."

The following is an account of the lapis lazuli mines of Badákshán taken from Wood's "Personal Narrative, &c."

"Firgamu stands at the head of the fertile portion of the Kokchan valley, which south of this takes the name of Koran. Beyond Firgamu the mountains rise directly from the bed of the river. * * * Where the deposits of lapis lazuli occur, the valley of the Kokcha is about 200 yards wide. On both sides the mountains are high and naked. The entrance to the mines is in the face of the mountain on the right bank of the stream and about 1,500 feet above its level. The formation is of black and white limestone, unstratified, though plentifully veined with curved lines. The summits of the mountains are rugged and their sides destitute of soil and vegetation. The path by which the mines are approached is steep and dangerous, the effect of neglect rather than of natural difficulties. The mountains have been tried for lapis lazuli at various places. The shaft by which you descend to the gallery of the principal mine is about 10 feet square, and not so perpendicular as to prevent you walking down. The gallery [at the bottom] is 80 paces long with a gentle descent, but it terminates abruptly in a hole 20 feet in diameter and as many deep. The width and height of the gallery though irregular, may be estimated at 12 feet, but some places where the roof has fallen in, its section is so contracted that the visitor is forced to advance on his hands and knees. * * No precaution is taken to support, by means of pillars, the top of the mine, which, formed of detached blocks wedged together, requires only a little more lateral expansion to drop into the cavity. Any further operations can only be carried on at most imminent risk to the miners. The temperature at the further end of mine was 36° Fahr., while in the open air it was 29°.

"The method of extracting the lapis lazuli is sufficiently simple. Under the spot to be quarried a fire is kindled, and its flame fed by dry furze is made to flicker over the surface. When the rock has become sufficiently soft, it is beaten with hammers and flake after flake knocked off, till the stone of which they are in search is discovered. Deep grooves are then picked out round the lapis lazuli, into which crow bars are inserted and the stone and part of its matrix are detached.

The workmen enumerate three descriptions of lajward, these are the *neeli* or indigo colored, the *asmáni* or light blue, and the *subzi* or green. Their relative value is in the order in which I have mentioned them. The richest colors are found in the darkest rock, and the nearer the river the greater is said to be the purity of the stone. The search for lajward is only prosecuted in the winter, probably because labor in the mine being compulsory, the inhabitants are injured less by giving to it in a season of comparative idleness, than when their fields require attention. Perhaps also during the cold of winter the rock may be more susceptible to the action of heat and thus be more easily reduced than when its temperature is higher. * * * The mines, the produce of which are exported to Bukhára and China, have been known from a very early period."*

Recent returns show the produce exported to be about 2 seers; what little lapis lazuli does come to the Punjab, is imported in small pieces and used for beads, charms, the stones of rings, &c. Some of these also come from Káshgár. Some persons have formed the erroneous idea that the common lajward of the bazar, which is everywhere sold at 4 Rs. a seer, is made from the genuine mineral, and might be profitably exported to Europe, when in fact every ounce of it in India is imported thence! The author of the "Makhzan-ul-Adwíya" admits that lajward is imported from Bombay.

Real lapis lazuli as a pigment has been long known to the people of the province; it is certain that many years ago it was sold at several rupees the tolah, a price which would be equal to that of real ultramarine in Europe.

The common lajward, answers to chemical test exactly like the real lapis lazuli, that is it is dissolved by diluted sulphuric acid, its color being destroyed and giving off a smell of sulphuretted hydrogen. In fact the lajward made in Europe consists of the same substances artificially combined as exist naturally in the lapis lazuli. It is, therefore, properly an artificial but not an *imitated* ultramarine, as the ground cobalt glass would be. The coloring matter was discovered to be due to the action of sulphide of sodium on the other constituents.

In 1828, M. Guimet succeeded in making some of this color, guided by the analyses of other chemists and by the remarks of M. Tassaert, that a blue substance like ultramarine was occasionally produced on the sandstone hearths of his reverberatory soda furnaces.

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* Chapter XVII. of "Wood's Personal Narrative of a Journey to the source of the Oxus, by the route of the Indus, Cabul and Badákshán."

M. Gmelin gives a receipt for the manufacture, which is to mix in a Hessian crucible, 2 parts sulphur and 1 of dry carbonate of soda; these are to be heated to redness till the mass fuses, and then a mixture of silicate and aluminate of soda, containing 72 parts of silica, and 70 of alumina is to be added, sprinkling it by degrees, and the crucible exposed to the fire for an hour*. It is said also that kaolin heated with sulphur and carbonate of soda does as well. An imitation lapis lazuli used to be made in Europe by grinding to an impalpable powder glass, previously colored blue with cobalt, but this is not common, and is certainly not the kind in use in India. The native standard book on Materia Medica, entitled "Makhzan-ul-Adwiya," gives the most absurd account of the making of ultramarine; showing, however, that the idea of an artificial color is familiar to the natives. The method related is probably founded on some faint reminiscence of the natural appearance of the lapis lazuli, confused with an account of the manufacture, which the author may have imperfectly heard or read, and still more imperfectly understood. It shows how a "little knowledge is a dangerous thing," and how much we need to strive to diffuse some genuine chemical and physical knowledge, and displace the teaching of such rubbish as the following:—"The imitation lajward," says the learned author of the "Makhzan," "consists principally of mercury and sulphur (he says the same of rubies a little further on!) The sulphur and mercury are to be mixed, the sulphur in greater proportion, and to this is added a portion of gold ore (*mádah-i-zabah*), these are to be moistened with a solution of yellow arsenic (*zarnikh*), one part of this compound is mixed with three parts of alum (*zák*) and sand, the whole is then ground together, after which a small quantity of solution of salt is poured over it, and the mass stirred several times with a bar of red hot copper, which, acted on by the ingredients, imparts a color to the mass. At first the color obtained is green, but after a time, when dry, it assumes the lapis lazuli blue." Another process is described as taking pieces of marble, and soaking them in vinegar and then in dung of animals, after which it is ground, &c. This latter is probably the glimmering idea of the process of making the real blue from lumps of lapis lazuli, which are heated and powdered as previously described. In England, real ultramarine sells as high as £5 an ounce, and a cake of it prepared as a water color costs 21*s.*; artists say that it differs from the artificial, in producing a greater degree of airiness and purity of tone in a picture.

* Ure's "Dictionary of the Arts and Sciences." Art. Ultramarine.

352.—[4660]. "Hartál" orpiment from Káshkár. Peshawur Exhibition Committee. Value Rs. 16 per maund.

353.—[857]. Another sample of hartál, from Swat.

In these places it is found native in the hills north of Swat; it is also used as a medicine in skin diseases and syphilis.*

354.—[706]. Litharge from Jagádri. Deputy Commissioner.

Amballa Sample.

Jagádri is a great place, for the preparation of metallic oxides, &c., especially those used in native medicine. Borax is refined at this place, and the oxide of lead or massicot manufactured (*see* Mineral Drugs). The litharge is a dingy yellow oxide of lead, prepared by gently oxidizing metallic lead by a stream of air. Red lead or minium, can be made from massicot, by exposure to the flame of a reverbatory furnace during about 48 hours.

KAHI AND HERA KASIS.

These are earths containing in greater or less quantity and purity, salts of iron in the form of an anhydrous sulphate; in the pure samples it takes the form of a whitish or cream-colored radiated crystalline mass. This substance is largely imported from Pind Dádan Khán, at which place it is of superior quality, but it also abounds at Kálábágh and other places. Kahi is also seen as a manufactured salt, obtained by dissolving and re-crystallizing the sulphate contained in the earth and shales, and which separate being insoluble (*see* note to the Shahpúr samples.)

There are several sorts of kahi.

"Kahi safed," is a sulphate of iron and alumina.

"Kahi sabz," is an impure green vitriol, a sesqui-sulphate of iron, and made by dissolving iron in sulphuric acid. This is usually a manufactured product, the green vitriol of commerce (proto-sulphate of iron) is called "híra kasís," a term which is in-

* See Appendix to Dr. Bellew's "Report on the Yusufzai Country."

correctly extended to earths naturally impregnated with iron salts.

"Kahi zard," is only a yellowish variety of the kahi safed, it is a sesqui-sulphate produced probably by the decomposition of iron pyrites *in situ*. There is also an impure dark variety of earth like a black shale, containing sesqui-sulphate, and called kahi siyah.

"Kahi surkh or lál,"—red kahi,—has no connection with the iron salts. It is bichromate of potash, and is always imported from Europe.

Kahi can be produced by concentrating the mother liquid of alum shale. It contains sulphate of alumina, and sulphate of proto and sesqui-oxide of iron.

Kahi often resembles "sajji matti" in appearance, and is sent by mistake for that product from several districts.

355.—[710]. Kasis (kahi sabz), sulphate of iron from Sirmúr, a grayish green earth containing iron in abundance. THE RAJA OF SIRMUR.
Simla.

356.—[4666]. Kahi safed. HIS HIGHNESS THE MAHARAJAH.
Kashmir.

357.—[4667]. Kahi siyah.

Of these earths, both containing salts of iron, the kahi safed is the purest, both are used in dyeing leather black, and in dyeing "khâki," or gray, and also black, to produce which, the cloths to be dyed are first dipped in a solution of galls or other substance containing tannin, and the iron acting on this according to the strength of the decoction used, produces shades of gray and black. Lime juice is further added for black dyes.

358.—[568]. Kahi mitti. An earth containing iron as a sulphate, Kálábágh. DEPUTY COMMISSIONER.
Bunnoo.

This is abundant, but not much used in the place of production.

The Amritsar collection exhibits all three varieties —"safed," "sabz," and "siyah."

359.—[910]. Sulphate of iron, from Namal. MR. MATHEWS.
Shahpur.

360.—[512]. Kahi mitti, from Chitta, in the Salt range.

This is a shale containing sulphate of iron and alumina.

Associated with the black alum shales alluded to in the account of alum manufacture, but occurring in smaller quantity, are gray shales with silky crystals of anhydrous protosulphate of iron. The kahi is prepared by mixing the pounded shale with the mother liquid for the crystallization of the alum. The mixture is then allowed to cake up and dry in the sun; when dried, it is once more treated with the alum liqour and once more dried, after which the residue assumes a tawny yellow color. This is a mixture of alum and sulphate of iron, the latter largely predominating.

Samples of kahi are included in the Jálandhar collection, but are not produced in the district.

361.—[261]. Kasís, from Haripúr. LOCAL EXHIBITION COMMITTEE.
Kangra.

362.—[358]. Kasís, or white vitriol, from Swat. Value Rs. 16 a maund.
Peshawur.

It is used by cutlers.

SULPHATE OF COPPER.

363.—[156]. "Níla tútya," blue vitriol, (sulphate of copper), from Nighána, Bhagúl, Buhal and Ketari; average value, Rs. 1 per seer. LOCAL EXHIBITION COMMITTEE, HISSAR.
Hissar.

This is extracted from ore similar to that producing the metallic copper (*vide* supra). The stone when pulverized is thrown into earthen vessels filled with water, and allowed to stand during the night, after which the liquid is poured into another vessel and the crystals of blue vitriol obtained by spontaneous evaporation of the liquid in the same way as alum.

364.—[629]. Sulphate of copper. Singhána. DEPUTY COMMISSIONER.
Gurgaon.

365.—[4522-3]. Sulphate of copper,
Amritsar. two kinds, viz., níla tútya "wilayití" and "desi."

Of this substance there are both the imported and native made. The former is distinguished by its large crystals of a fine blue, the latter by its efflorescent small crystals, and opaque pale color. It is made at Amritsar by boiling sheet copper or copper filings with sulphuric acid, and evaporating the residue. This substance, besides being used as a color and also as a drug, will be noticed again under the class of Chemico-pharmaceutical substances.

ACETATE OF COPPER.

366.—[ ]. Zangár, sub-acetate of
Lahore. copper, prepared in this country.

When ground up it gives a beautiful turquoise or verditer blue.

367-68. [ ]. Two samples of
Amritsar. zangár in crystals. LOCAL COMMITTEE.

SUB-CLASS (C.) SALTS, WITH ILLUSTRATIONS OF THE METHOD OF MANUFACTURE.

The principal substances which are classed under the head of salts, are common rock salt, and preparations of evaporated salts,—saltpetre (nitrate of potash)—alum—"sajji" or barilla—"naushádar," or sal ammoniac—and borax, or "soháge." All these are important articles of trade. Another salt, called "kalar," an efflorescent sulphate of soda, is so prevalent in some parts of the country, as to destroy cultivation: the sulphate has not yet been utilized, but many efforts have been made to discover the cheapest method of neutralizing its evil effects on the soil. H. H. The Rajah of Kapurthala offered a prize of Rs. 200, for a cheap and effectual method of destroying it. The manufactories of saltpetre and the salt mines of the Punjab, are sources of permanent revenue to the State. In some places, as at Jhung and Sirsa, there is income derived as "sair," from the manufacture of barilla; and in Gurgaon or Hissar from the brine pits.*

COMMON ALIMENTARY SALT.

The principal beds of salt occur in the red marls and sandstones of the Devonian group, on the southern side of the Salt range. They are from 150 to 200 feet in thickness, but masses of salt are also found interspersed among the marls and detached from the main beds.

There are three principal varieties of salt, viz., red, white and crystal salt. The red is preferred for merchandise, as it does not break up so readily as the others. The white variety not unfrequently passes into a gray or greenish and purplish color. The crystal salt when pure is a mineral of great beauty, some of the finest crystals sent to the collection are represented in the annexed plate, together with some of the vessels which have been carved out of the rock salt. In chemical composition all the varieties resemble one another. The red color of the salts is said to be due to organic matter, and not to iron—the gray or other opaque colors are the result of an admixture of soil or other impurity. The collection in the Lahore Museum, contains the following varieties in color:—dark red, light red, pink, white tinged pink, orange color, pale yellow, transparent white, opaque white, efflorescent crystalline white, greenish white, pale gray, dark gray, (amorphous), black (granular crystalline) purplish.

The Bahadur Khail Trans-Indus mine, yields black salt, and this is shipped at Esa Khail for export, having specific uses of its own. To the Dera Ghází Khán district 500 maunds of red salt are annually imported by river, and of the Bahadur Khail salt 700 maunds.

The salt when it occurs in the main beds is remarkably pure; it contains a trace of sulphate of lime, but is free from chloride of magnesium—on which account it is very little deliquescent.

The beds of salt indicate that their formation is due to crystallization from a salt

* In 1860-61, the revenue derived from brine pits and saltpetre pans, was Rs. 79,730; and in 1861-62, Rs. 49,205.

solution or brine; in the extremities of the beds the salt is much mixed with the marl, but in the centre it is pure, and there are no cavities in the main body containing crystals, from which sublimation might be inferred.

The salt beds have evidently been upheaved, as appears from the frequent faults and dykes, sometimes filled up with debris of gypsum, breccia, sandstone, &c. It is impossible to give a better account of the working of the mines than has already been done by Dr. Fleming. I therefore extract his account verbatim.*

"When a spot has been fixed on as a promising locality, a tunnel is cut in the marl about 5 feet high and 3½ broad, and carried on till salt is reached, the proximity of which is generally indicated by the marl becoming moist and assuming more the character of a dark red clay. The mineral is then excavated as long as a supply is procurable, no attention being paid to leaving pillars at intervals, for the support of the workings, the consequence of which is that great annoyance is experienced from the falling in of the roof of the mines: and accidents to the unfortunate miners themselves are of frequent occurrence. Should the shaft have been sunk on, and reached only a mass of salt, after this is worked out, the mine is either abandoned or a gallery driven to a greater depth into the marl, until another large mass is found or the real salt bed reached. As this invariably has a strike and dip corresponding to the strata superior to the marl, the stratification of the rock guides the miners in their onward course. These mines are nothing more than huge caves entirely excavated in the salt, which is seldom or never worked through, either in the floor or roof, because as the salt approaches its matrix it becomes intimately mixed with marl, and is highly deliquescent from containing magnesia. † In almost every mine in the Salt range, the evil of having left no pillars to support the roof is experienced, and some of the largest and best mines have been in a great degree abandoned in consequence of their becoming filled up with huge masses of salt, gypsum, and marl, that have fallen in from above.

"As the marl is the lowest rock of the range and dips under all the others in a northerly direction at an angle of from 25° to 40°, as might be expected, much trouble is occasioned by the filling of the mines with water when they reach to any great depth. During the rains too, in July, August and September, the water rushes through passages in the marl into the mines, and by detaching large portions renders them quite unsafe. In these months the miners desert their work, partly on account of its dangers, and partly on account of the intense heat, and the numerous fleas and musquitoes which infest their neighbourhood.

"In consequence of the irregular way of carrying on the workings, the passages into the various mines exhibit at present a succession of ascents and descents, which sometimes become so polished and slippery as to render walking over them a matter of some difficulty.

"In extracting the salt, the chief instrument used is a hammer, pickshaped and hard tempered at one end, and with a round head at the other. A mass of salt being fixed upon as the scene of operation a portion is lined off, about 2 feet thick, and along this a groove is cut with the sharp pointed hammer to the depth of some 8 or 10 inches. Larger sharp pointed hammers as wedges are then introduced at intervals along this line, and on their broad heads a series of sharp blows are inflicted. This generally detaches a block of salt, which is then broken up into lumps of a convenient size for being carried out of the mines. The amount of waste resulting from such a method of working is immense, and as powdered salt is not saleable as long as lumps can be had, it is generally shovelled into the bottom of the workings, where there frequently is a brine pool ready to receive it.

"Instead of making a deep groove, along the limits of the mass it is desired to detach, we believe the object could be equally well attained by adopting the plan used in granite quarries in Scotland, which is as simple as it is effective; small holes 3 or 4 inches long, 2 inches broad, and 4 deep, are picked out at intervals of 8 or 10 inches in the mass which it is desired to split, into these holes truncated wedges are introduced. Each of these is in succession driven into the holes and continues to receive sharp blows till the mass splits, which is at once known by the elasticity of the stone causing the wedges to jump out of their holes, a lever is then inserted into the crack and the divided portions separated. Were this process intro-

* Selection from the Public Correspondence of the Punjab Government. No. XXII., p. 271, *et seq.*

† It must be remembered that most of the mines being already excavated when they came under British authority, their present state is an evil for which there is no help. The unsupported excavations, as remarked by Dr. Oldham, are not the result of our system, but have been so since the Sikh times when they were worked. Dr. Oldham goes on to say that the shafts and galleries that we sink *now*, are sunk as well as they are in any mines in the world.

duced, the saving would be considerable.* On account of the dangerous state of the roof of nearly all the mines, gunpowder is seldom used, and all the work is done by the pick and hammer.

* * * * *

"From the want of circulation of air in most of the mines and the dampness of the atmosphere, the heat is most oppressive; and from the filthy habits of the miners, the stench in some of the mines is quite overpowering. In the month of December, when the temperature of the external air was 71°, in the Bugee mine at Kheura, the thermometer indicated a temperature of 81°.

"Men, women and children, indiscriminately pursue the avocation of salt miners. Families generally work together, the mother and children being chiefly occupied in carrying on their backs to the mouth of the mine, the masses of salt which the father has quarried. They are a somewhat discontented set, and strikes are by no means uncommon.

"The pay of the miners varies a good deal. At Kheura, Mukrach and Varchá, salt is turned out at the mouth of the mines at the rate of Rs. 3-12 for 100 maunds (£0-7-6 for 8,000 lbs.). At Sardi they receive Rs. 2-8 (5*s.*), while at Kálábágh, where the salt occurs in enormous masses at the surface and only requires to be broken up and removed, they receive Rs. 2-14 for quarrying it, and Rs. 1-5 per 100 maunds for conveying it to the depôt at Mári: oil and tools are supplied by the miners themselves.

"The quantity of salt that can be turned out in a day by a good workman is about 10 maunds (800 lbs), which at the present rate of Rs. 2-8 for 100 maunds, would give the miners 4 as. or 6 as. a day.

"Where, however, a family work together, the earnings amount to something considerable.

"The general appearance of the miners varies greatly. At the end of the hot season they appear very sickly and sallow, but towards the close of the cold season, they do not appear to us to have a more unhealthy aspect than the inhabitants of towns in the Punjab generally have. They, however, suffer a good deal from sickness, but this is probably owing more to the position of their villages and their filthy habits, than to their trade. Certain diseases, such as opthalmia and pulmonary complaints, are very prevalent among them, and doubtless result from the injurious effect of the finely powdered salt acting as an irritant on the mucous membranes. Fever is very prevalent among the miners at Kheura, where (perhaps from the confined position of their mine) they look more sickly than at most of the other mines.

"Goitre is a frequent complaint, but particularly so at Kálábágh, where every one seems more or less affected. This the natives ascribe to the Indus water, which is generally of a milky color, from the fine calcareous mud mechanically suspended in it, and which the addition of a little alum speedily removes."

The mines are of two kinds; one where the salt rock is approached by galleries and excavations—the other where, as at Kálábágh, or the Trans-Indus mines, the salt is at the surface of the rocks and is quarried rather than mined.

Dr. Fleming gives a very graphic account of the Kheura mine, the principal of these excavated mines—I extract it from the memoir of his visit in 1848.

"The mine," he writes, "is a little to the east of the village, and on a higher level, the path leading to it, passing over red marl containing angular masses of gypsum. The entrance to the mine is by an opening cut in the marl about 7 feet high and leading into a passage which preserves throughout a height of 6 feet, and a width sufficient to allow two individuals to pass. From the entrance to the end of the workings the distance is 640 feet, where a chamber has been excavated entirely out of the rock salt, 40 feet long by 30 feet broad, and about the same height, in which at the same time we visited it, men, women and children, were busily engaged quarrying the mineral, by light of small oil lamps formed of the salt and hung by iron hooks on its walls, the crystalline surface of which, reflected the light on a deep pool of brine situated in one corner of the chamber, and which is said to communicate with several of the neighbouring shafts.

"In the interior of the mine which was remarkably dry, the heat was most oppressive, and the thermometer hung on the rock salt stood at 85°, while in the shade at the mouth of the shaft it indicated 75°.

"The appearance of the miners as seen in the dim light which illuminated the mine was highly striking,

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* The supply of salt is undoubtedly large, but as we are utterly ignorant of its actual extent, it becomes a matter of considerable importance to save it and waste none. All the powdered waste and impure salt, might be collected and dissolved in tanks, when the impurities would quickly subside and the clear brine would run off into shallow pans and crystallise into excellent salt. In the Austrian mines this process is found to be worth while, even though fuel is required to effect the evaporation; but in the Salt range the process would be quite unattended with any expense as the heat of the sun would suffice. If this were done, and if also the brine springs at the foot of the hills were utilized, the produce would be immense. The point is well worthy the attention of Government.—B. P.

their faces and bodies being covered with a saline incrustation. Their dress is of the lightest description, the men wearing nothing but a bit of cloth round their loins, and a pad of "numdah" or thick woollen cloth tied over their skins to protect them from injuries from the sharp angles of the salt or the blows of their instruments. The salt is generally removed from the mine in square lumps of such a size that two will form a good load for a camel. The miners receive from Rs. 2 to 2-8 for 100 maunds, according to the quality of the salt turned out. Around the village of Kheura there are no less than 10 shafts sunk into the red marl for the purpose of extracting the salt. From the foot of the hills a narrow path, strewed with boulders and masses of rock which have fallen from the heights above, leads through a deep ravine to the salt mine village, which is built in terraces on its east side, and is inhabited by the miners and their families during the dry season. In the rains on account of the heat and the musquitoes they desert Kheura and take refuge in the small village of Tobee, which is built on the opposite side of the ravine, but at a considerable height above the salt mines, where they enjoy a cool breeze and an immunity from their winged tormentors. The inhabitants of these villages amount to about 650, of whom 400 are employed in the salt mines." *

At the Kálábágh mines, the mineral exists close to the surface and crops out behind the terraced houses of Kálábágh, forming a wall which overhangs the town. It is worked chiefly in the bed of a nullah, called "Lún." No shafts are sunk, for the rock has fallen down in immense masses from the height above, and it is only necessary to break it up into pieces for transport.

Elphinstone thus describes the town and mines of Kálábágh :—

"As we passed beneath, we perceived windows and balconies at a great height crowded with women and children. The road beyond was cut out of the solid salt at the foot of cliffs of that mineral, in some places more than 100 feet high above the river. The salt is hard, clear and almost pure. It would be like crystal were it not in some parts streaked and tinged with red. In some places salt springs issue from the foot of the rocks and leave the ground covered with a crust of the most brilliant whiteness. All the earth, particularly near the town, is almost blood-red, and this with the strange and beautiful spectacle of the salt rocks, and the Indus flowing in a deep and clear stream through lofty mountains past this extraordinary town, presented such a scene of wonder as is rarely witnessed."

The mines or rather quarries described by Elphinstone, are now closed, and the salt is extracted instead at Mari, on the opposite side of the river. Here also the salt is got at by quarrying; at first it is necessary to remove the gravel and alluvium that lies in front, but after that the salt is pure.

During the Sikh times, salt was worked at every available place, but now, with a view to facilitate the collection of the revenue derived from it, the extraction is confined to the five mine stations—Kheura, Mukrach, Sardí, Chúa Varchá, and Kálábágh. Some of the Trans-Indus mines of Kuhat, &c., are not now worked; there are, however, specimens of the salt they yield exhibited in the Kuhat collection. In the sequel will be found an account of the Kuhat mines, contributed by the Deputy Commissioner. The salt used to be sold for Rs. 2 a maund, and now, since 1861, has been sold at Rs. 3. In 1850 and 1851, the quantity of salt produced was as follows (omitting fractions): in 1850, 7,58,603 maunds, yielding a revenue at Rs. 2 a maund, of Rs. 15,37,400. In 1851, it was 6,40,618 maunds, and the revenue, Rs. 12,81,295.

In 1861-62, when the tax had risen to Rs. 3 a maund, the revenue was about 28 lacs of rupees, or £280,000; in 1862-63 it was Rs. 30,31,568.

The Kheura mines are the most productive, next to these the Mukrach, and least of all the Chúa Varchá.*

Salt when extracted is collected at depôts in the immediate vicinity delivered to the traders on presentation of their "dákhilas." These

* Journal of the Asiatic Society, No CXCVII, November 1848.

* The out-turn of salt, and revenue derived, from the Kheura mines alone for the last four years is as follows :—

	Maunds.		Rs.		Rs.
In 1861,	9,16,105	at	2-2	value,	19,46,724
,, 1862,	7,50,490	,,	2-2	,,	18,93,413
,, 1863,	7,35,136	,,	3	,,	22,06,408
,, 1864,	8,92,122	,,	3	,,	26,76,368

dákhilas are orders to the patrols at the mines to deliver certain quantities of salt to the bearer; they are issued by the Government treasuries at Jhilam, Shahpúr, &c. The merchants pay into these treasuries the value of the salt they wish to purchase, and receive in lieu a "dákhila;" this saves all money transactions at the salt depôts. Dákhilas are also granted from the office of the Collectors of Salt customs. They are transferable and pass like bank notes among the traders.

The transport of salt is subject to stringent regulations. The customs line is supported by its patrols and assistant patrols, who have liberty to search on suspicion for contraband salt, to destroy small quantities where found, and to seize and detain larger stores; there are also rules as to the removal of salt from the depôts, requiring it to be done within a given time.

The manufacture of salt by evaporation from water in the salt hills, is strictly forbidden; and in other districts, the manufacture of salt obtained in the process of making saltpetre, is also forbidden. The brine pits of Gurgaon are under tax, and will be mentioned hereafter.

It has been remarked, that some of the mines worked by Government at the present day are worked on the old and bad principles which were in vogue 300 years ago; but it must be remembered, that taking up the salt works as we did at a time when the mines had already been excavated, we had no option but to continue in the same way. If a *new* mine is opened, it is dug on principles as correct as modern Engineering can furnish.

We have no accurate historical information as to the first working of these mines. They are alluded to in the "Ayín Akbarí," and Dr. Fleming records an assertion of the natives that the mines were first worked in the reign of Akbar (A.D. 1556), who was informed of the existence of salt by a certain Asp Khan, on condition of his receiving as reward during his life-time a sum equal to the whole of the wages of the miners employed in digging it. Salt was sold at Lahore in this reign at six annas a maund; Dr. Fleming writing in 1851, adds,—"In the Kuhát district at the present time it may be bought for use, Trans-Indus, at four annas a maund!"*

With regard to the system of work pursued in the mines, it may here suffice to say that the miners are under the control of the Collector, who gives permission for cutting and removing the salt, fixes the price to be paid to the men engaged, and settles disputes. The miners appear to be somewhat discontented, and an objectionable system of making contracts with them exists.

The roads and works of every kind in the mines, are under the Executive Engineer, a circumstance fraught with no little difficulty and inconvenience to the Collectors.

The working of the mines notwithstanding the energy of the Collectors is still very faulty. Dr. Oldham says that in some places the waste of salt is something fearful, amounting to a tenth of the whole produce. He adds that the loss is sometimes equal to the total quantity produced by a large mine in Europe! and makes the very just remark that the salt so wasted becomes positively injurious, by contaminating with brine all the water that comes in the way on its descent to the plains.

He advocates selling the small and broken salt, which is left by the quarrying operations, and also by the purchasers of salt, who chip the salt they buy with stones till it forms carriageable lumps, at a lower rate than the large salt; this he thinks, and no doubt justly, would induce the merchants to buy it readily, since in point of fact it is just as good salt as the other. Much still remains to be done as to roads and improvements; Mr. W. Purdon in 1854, and following years,

* The high rates of the Cis-Indus mines do not apply to the mines across the river, but the salt from the latter is not allowed to come into territories Cis-Indus, which are supplied with the monopolized salt.

did much. Facilities for traffic to Pind Dádan Khán, where all the salt goes, are much needed. It may be proper to mention that the Salt range is called "Kháwá" by the natives, and the salt is usually termed "Laborí nimak" in the bazar: the name of the metropolis, has no doubt, reference to the Government monopoly of salt. It now sells at Rs. 3 a maund at the mines depôt; the price having been raised from Rs. 2 in 1861.

Salt is exported to all parts of the Punjab, and goes even beyond the frontier on all sides. A special trade is carried on between Hazára and Kashmír in exchange for "ghee." Punjab salt is used throughout Kashmír by the richer classes, and also in the Jammú territory. Beyond these districts the poorer classes and the army (by order) consume Changthán and Thibet salt.

Of the salt mines near Mandí, and the Drang and Gumatti mines, producing a dull gray salt, I shall speak hereafter in describing the specimens exhibited from the Kangra district. Suffice it here to say that they are mere excavations or pits, presenting no particularly interesting features. The salt is not variously colored, or crystalline and sparkling like the Salt range salt, but is of a dull gray, being much mixed with impurities. It is far cheaper than pure salt, and is on this account used by the poorer classes in the hills and submontane districts. A considerable trade in this salt is carried on by the hill people, who employ numbers of small cattle to carry it. These animals often heavily laden find their way with wonderful sagacity over the steep and stony paths they have to traverse. Donkeys and mules are employed also. The salt is usually bartered for gram, rice, and other articles of food.

II. Evaporated salt is to be met with in various forms under several different names. Salt can be obtained during the manufacture of saltpetre, but this process being used as a method of avoiding the duty on salt from the mines, the practice was prohibited,* and the saltpetre pans subjected to the necessity of a license.

Under the head of common salt, are included in the collection several "fancy salts," if they may so be called. Such are the "kálá nimak," black salt; and "nimak manyárí," "nimak náli," and others; but their use being principally confined to native medicine, they are included in Division III. Sub-Class (A). Chemico-Pharmaceutical Substances.

The great manufacturing district for evaporated alimentary salt is Gurgaon; where it is obtained by exposing the brine or salt impregnated water in shallow pans or pools to the heat of the sun.

The neighbouring foreign territory of Jaipúr also produces salt, especially the lake of Sámbhar, the salt of which is celebrated.

These salt works supply the north-eastern parts of the Punjab, both internally and for export, just as the rock salt of the Salt range mines supplies the upper Punjab.

Some of the salt villages are within the Gurgaon district, but those producing the best salt are in the pergunnah of Jhajjar, the territory recently taken from the Nawáb of Jhajjar.

The salt is generally classified into two kinds—the "Salambha," and the "Sultánpúrí." The latter is the best.

Salambha salt is made in the Noh pergunnah, which contains twelve salt villages.

Málab,	Raniká,	Wúntka,
Bái,	Kherla,	Noh,
Manglí,	Salaheri,	Firozpúr,
Audbár,	Nizámpúr,	Salambha.

The Sultanpúr salt is made in the pergunnahs of Farraknagar, Jharsa and Jhajjar. Jhajjar contains five villages.† :—Sultánpúr, Mubárakpúr, Kaliáwás, Zahdpúr, and Fatihpúr.

* See Act XXXI. of 1861. Sections 5 and 6.

† Statistical Report on Gurgaon District. By Mr. A. Fraser, C.S.

Farraknagar contains one, viz., Basirpúr.

Jharsa contains three—Syadpúr, Mahmúdpúr, and Sádharáná.

The principal works, both as regards amount and quality of produce, viz., Sádharáná, Syadpúr, Mahmúdpúr, Sultánpúr, Mubárakpúr, and Basirpúr, lie in a cluster, occupying an area of four miles in length and about two in breadth. They produce, or at least are capable of producing, without any expansion of works, about 7 lacs of maunds, equal in quality to the best salt in India.*

They are near the end of the great Najafgarh jheel; and the manufacture is carried on in a strip of land, forming a hollow between two sand-hills, terminating in the jheel itself.

There are altogether ten manufactories in the Mehal of Sultánpúr, three of which are situated in the Gurgaon district, and seven in that of Rohtak. Their produce is as follows:—

Average quantity produced annually.	Quantity removed annually.	Amount of duty realized annually.		
MAUNDS.	MAUNDS.	RS.	A.	P.
4,84,980	4,65,547	13,96,521	0	0

The salt works of the villages attached to the Jhajjar district, came into our possession after the execution of the Jhajjar Nawáb, subsequent to the fall of Delhi; and we also gained, owing to the treachery of the Nawáb of Farraknagar other salt works: prior to the outbreak we had Gurgaon villages producing the same description of salt as that produced at the Jhajjar and Farraknagar salt works, which is known by the general term Sultánpúr salt.

As to the income which was derived under native rule, the Jhajjar works were leased by the late Nawáb, for I believe 30 or 40,000 rupees; and those at Farraknagar for 8,000 rupees; but as regards the works in the villages of the Gurgaon district producing Sultánpúrí salt, no duty was realized after they came into our hands on the death of the Begum Sumroo.* As respect the works at Noh, and its vicinity, producing what is called Salambha salt, I find that in the Emperors' time, one anna was charged on a lakh of maunds, but no lease was resorted to. On British supremacy being established Government at first divided the salt with the producer, half and half; this arrangement lasted until 1830; it also involved the payment of a duty at the place where the salt was made, of eight annas a maund. In 1831-32, Government fixed its share at one-fourth of the produce, and levied a duty of Rs. 1 a maund besides. A lease was fixed for the years 1830 to 1835, the farmer being authorized to collect one-fourth of the produce; and also the duty before mentioned. Upon the settlement of the pergunnah, which took place in 1836, the Government share in the salt produced, was remitted, and the land occupied by the salt works having been regarded as a cultivated area, a general rate for the whole was fixed.

As regards the villages in the Jharsa pergunnah of Gurgaon, producing Sultánpúr salt, it would appear that no notice was taken of the manufacture during the reign of the Emperors, but on Begum Sumroo's ruling the country, she collected half an anna per maund on the salt when manufactured, and on its sale from 10 to 29 Rs. on every Rs. 100 realized. When the settlement of the pergunnah of Jharsa was made, the Government share on the salt produced was excused, and its manufacture for a time prohibited; but upon Syadpúr, Mahmúdpúr, Sádharáná being leased to Gulzári Mull, a farmer, he was authorized to collect Rs. 19 on every Rs. 100 worth of salt sold, and when the farm of Sádharáná expired, the proprietors

* Correspondence in the Office of Financial Commissioner, from Commissioner of Customs, N. W. P., to Financial Commissioner, 16th January, 1860.

* The Begum realized about Rs. 6,000 a year from the salt-pits.

of the soil at Sádharáná exacted the same terms from persons who produced salt on their lands.

The total duty realized on Sultánpúr salt was in 1859-60, Rs. 2,58,160-12-9 ; in 1860-61, Rs. 3,47,669-8-0.

The town of Bádshapúr is the mart whence the Sultánpúrí salt is exported eastward.

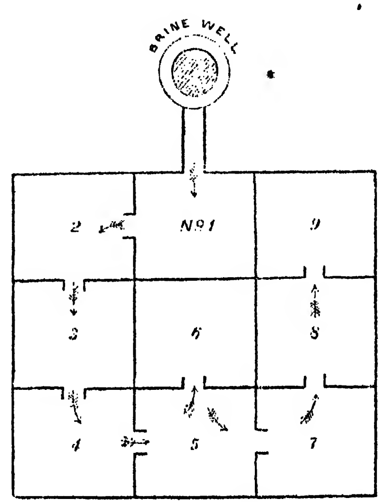
The proprietors at Noh appear to realize from each hereditary cultivator and tenant-at-will, in addition to the sum usually charged for the land held by him, Rs. 1 per pan.

The following is a Table showing the salt producing area for the Salambha kind:—

Number.	Names of villages.	Area producing salt.		
		Begahs.	B	B.
1	Nizámpúr, ...	15	0	0
2	Málab, ...	80	0	0
3	Noh, ...	60	0	0
4	Dundaherí, ...	1	0	0
5	Kherla, ...	20	0	0
6	Untka, ...	10	0	0
7	Firozpúr, ...	2	0	0
8	Salambha, ...	4	5	0
9	Sallaheri, ...	8	0	0
10	Adbar, ...	1	0	0
11	Táin, ...	1	0	0
12	Báí, ...	5	0	0
	Total,* ..	207	5	0

The manufacture of the salt is conducted as follows:—

A number of square pans or shallow tanks are arranged at different levels, and communicate one with another, so that the manufacturer can open the communication at will, and allow the brine to pass from one pan to another. One of the pans or tanks communicates with the salt well, the water of which is raised by a bucket and rope over a wheel, which apparatus is called a "láo." The pans or beds are made about 20 feet square and 6 inches deep,* being cut in the ground and lined with plaster. They form sets of eight or ten together, and each pan is at a different level from the rest. The pans are called "kyári." The annexed sketch shows their arrangement.



The brine enters No. 1, and remains there one day; at evening it is allowed to flow into No. 2, and so on till it gets to No. 5: here it is tested, and if the evaporation has gone on long enough and the liquid is thick, it is allowed to pass into Nos. 7 and 8, and 9, where it finally loses all its water by evaporation, leaving only crystalline salt. If the water is not sufficiently evaporated when it gets to No. 5, it is turned into No. 6, and left there till it is: then it passes to Nos. 7, 8, and 9, as before. In the hot weather the process requires four or five days, but in winter it sometimes take three or four weeks. The salt is taxed by the custom's department after manufacture. The salt, when nearly crystallized, is stored in pits, so that the superfluous moisture of the crystals may be absorbed.

The principle places to which the salt is exported are—Mathra, Hátras, Akbarábád,

* Statistical Report on the Gurgaon District. By Mr. A. Fraser, C. S.

* In the sketch sent me by the Deputy Commissioner, of Gurgaon, the pans are marked 12 × 27 feet × 7 inches.

Kasganj, Kálpí, Atára, Farrakábád, Cawnpore, Allahábád, Lucknow, Murádábád, Shahjahánpúr, Sahâranpúr, Jawálpúr, Khúrjah, Sikandarábád, Bulandshahr, Delhi, Meerut.

I now proceed to the enumeration of the specimens, which illustrate the foregoing descriptions:—

369.—[254]. Rock salt from the Kangra. • Drang mine. Mandí. THE RAJA OF MANDI.

370.—[255]. Rock salt, from the Gumatti mine, Mandí. THE RAJA OF MANDI.

These are grayish salts, quite unlike the beautiful clean salts of Kálábágh; in color they resemble Graywacke rock; they have the appearance of having been deposited layer by layer, but are not lamellar in cleavage: the gray salt is varied by reddish streaks. Geologically, the formation of this salt is the same with the beds of the Salt range, only here the strata reach their extremity and have become much mixed with impurities. This dull gray salt is very largely used all over the hills. Indeed it may be said that all the Himálayan states are supplied either by Salt range salt, if they are near the plains; with "gunna lún" (gray salt) if intermediate; and with Tibet salt if further north, and beyond access from the mines. All the bunyas about the lower hill districts keep both gray and Lahorí salt on sale in their shops.

371.—[256]. Alimentary salt, used at Lahaul, obtained from Changtháu in Thibet. LOCAL EXHIBITION COMMITTEE.

This salt, called in Thibet, "sa," comes from Changthán.

A large quantity is imported into Ladákh, mostly though the Kardár of Ladákh for consumption in his province, and for the Maharaja of Kashmír's army throughout the Jammú and Kashmír territories. The poorest class in Kashmír consume this salt, the richer people use Punjab rock salt. In the Jammú territory only Punjab rock salt is used. The Kashmír government has the monopoly of this salt.

On the Changthán border, where the Ladákh authorities have a shop for the sale of salt, its price is 1 maund and 15 seers per rupee; at Lé, it sells for 30 seers for a rupee; and in Kashmír, 16 seers per rupee. The purchase, sale, and transport is under direction of a Kardár of the Kashmír government, the monopoly having existed for the last seven years. The Changthánis barter their sal for grain (which is not produced in Changthán) and the bartering is also carried on in the case of other articles of trade, as wool, sulphur, &c.

The imports to Kashmír value at Rs. 20,000.

372.—[486]. Black rock salt. Kheura Jhilam. mine, Salt range. LOCAL EXHIBITION COMMITTEE.

373.—[488]. Red rock salt. Kheura mine, Salt range.

374.—[489]. Crystals of salt (natural), do.

375.—[490]. Amorphous salt, do.

376.—[10180]. 15 vases carved from Shahpur. rock salt, by JANI of Kálábágh. MR. MATHEWS.

The art of carving in rock salt has been long known and was practiced in the Sikh times. The workmen will readily copy in salt any pattern vase given them of a tolerably simple form.

(See *Engraving*, p. 69.)

377.—[504]. Natural crystals of rock salt, "shísha nimak," Kheura mine. MR. CHILL.

378.—[505]. Another specimen, from the Kálábágh mines.

(See *Engraving*, p. 69.)

379.—[506]. A series of 15 samples of rock salt, from the different posts in the Kheura mines, exhibiting the various colors of which salt is found—white, red, greenish-white, gray and blackish tint. MR. MATHEWS.

380.—[507]. A series of 8 samples, showing the products of the Kálábágh mines. MR. CHILL.

381.—[519]. A mass of white salt efflorescence, from Kathá, at the foot of the range. MR. T. W. MOORE.

382.—[594-96]. Samples of green and Kuhat. red rock salts, Nandrúga mine. LOCAL COMMITTEE.

383.—[595]. Black salt, from the Jatta mine.

This is not to be confounded with the artificial "kálá nimak," or black salt: the color of the specimen is natural, and of a deep purplish gray.

384.—[597-98]. White salt, a crystal, from Narí mine.

Salt is contained generally in the chain of hills running from the river Indus towards Bahádur Khail, in a direction from east to west. These hills are drained by the streams called the Tarí Tawi and the Káshí.

The mines now worked are five in number :—

1. Malgin, about 20 miles south of Kuhat.
2. Jatta, about 22 miles south-west of Kuhat.
3. Narrí, about 15 miles further on in the same direction.
4. Kharak, about 5 miles still further on.
5. Bahádúr Khail, about 50 miles south-west of Kuhat on the Bunnoo road.

The mines at the three first places are situated in low rugged hills, chiefly sandstone, in vertical strata and covered by low jungle.

The salt lies near the surface under (not unfrequently) a strata of red marl, and in color is black or dark green, the former is found chiefly at Malgin and Jatta. It is nearer the surface and as it contains a considerable quantity of sand and other impurities, it is only taken away when from press of work at the mines, the traders would be delayed in getting their animals laden with the better sort.

The transparent colorless salt, of which a specimen was forwarded to the Exhibition, is found at Narí and Kharak: the latter mine is now closed. It is not found in large quantity, and is taken away occasionally by traders more as a curiosity than from preference.

The red salt is found at Nundrága, near Shakkardarí, and being similar to the Cis-Indus salt, the mine is closed to prevent the smuggling which would otherwise take place.

The opaque white salt is the result of the action of water found in caves, &c.

At Malgin, Jatta and Narí, the salt is obtained by blasting in the usual manner; and the miners have two descriptions of pick, one heavy, weighing 10 or 12 seers, round and heavy at one end, and pointed at the other: the second pick is about 3 lbs. in weight, and of the size of a small axe; it is pointed at one end like the larger one.

At Kharak and Bahádúr Khail, the smaller instrument is alone used with a thick short chisel, and a stone for a mallet; blasting is not resorted to.

The rates vary at the different mines; at Jatta and Malgin a fee is levied by Government of 4 as. per maund; the approaches are difficult and bullocks are chiefly employed by traders, who consist of Khattaks, Afrídís, and Mohmands, from the Peshawur district.

At Nari the rate is also 4 as. per maund, and is chiefly frequented by camel owners, Khattaks, and men from Hashtnagar and parts of Yusufzai.

At Kharak a fee of 3 as. per maund is levied, and the mine is frequented by Thalls, Wazíris, Powindahs, &c.

At Bahádúr Khail* the Government fee is 2 as. per maund, and the traders are Wazíris, Ghiljis, men from Upper Meranzaí, &c.

At the two latter places the trade is carried on with both camels and bullocks.

In addition to the five mines worked, there are thirteen others in the same hills, which are kept closed and watched to prevent smuggling.

The quantity taken last year from the different mines was as under :—

From January 1863 to 31st December 1863.

Name of mines.		Quantity of salt.			Revenue to Government.		
		Maunds.	Sr.	Ch.	Rs.	As.	P.
Malgin,	... ...	98,429	30	0	24,607	7	0
Jattá,	... ...	1,11,249	22	8	27,812	6	3
Narí,	... ...	48,203	20	0	12,050	12	0
Kharak,	... ...	44,949	30	0	8,438	1	3
Bahádúr Khail,	...	82,298	30	0	10,287	6	6
Total,	...	3,85,131	0	0	83,196	1	0

EVAPORATED SALT.

(120-140). Twenty samples of evaporated salt, both Sultánpúrí, and Salambhaí; from Gurgaon. Báí, Bás, Untka, Málab, Noh, Dundaherí, Kherla, Salambha, Fázilpúr, Salaheri, Sultánpúr, Basirpúr, Sádharáná, Mahmúdpúr, Hamípúr, Gopálpúr, Mubárakpúr, Zahdpúr.

* The mine of Bahádur Khail supplies the whole of western Afghanistan with salt, and the Wazíris are the chief traffickers in the same.

In the autumn of 1849, the sale of salt at the Bahádúr Khail mine was suspended, until a rate of duty should be fixed for the whole of the mines. Two rupees per maund, the same rate as that of the Cis-Indus mines was the first scale decided on; but it being found that so high a rate had the effect of completely stopping the trade, it was soon reduced to one rupee, without, however, producing the desired effect of re-opening the trade. Thousands of men usually engaged in extracting or conveying salt from the mines to all parts of the country were thrown out of employment, and some disturbances occurred at Kuhat and Bahádur Khail, but passed off. Tranquility was restored, but the hill men had relinquished the salt trade, which, on account of the high duty, they considered beyond their reach. Things were in this state when in May 1850 the rate of the duty was finally reduced to a scale which was calculated to throw the salt trade open to every idle man in the hills and elsewhere who chose to undertake it. (From Taylor's Memorandum on Dera Ismail Khán, pages 34 and 35.)

385.—[164]. Crystallized salt, from Hissar. Sámbhar. Local Exhibition.

Properly speaking this is a salt which is obtained by evaporation from the lake of Sámbhar in Rajputáná, but there are many other places which produce a salt similar to it. It has a peculiarly pungent taste, and all salt of this character is called Sámbhar, whether actually derived from the lake or not; it is used both for culinary purposes and in medicine.

The Sámbhar lake itself has its western side in the State of Jodhpúr, and its eastern belonging to Jaipúr. The lake is about 22 miles long by 6 broad, but it is much diminished in dry weather, and augmented in the rainy season, when it becomes less salt.

The crystalline deposit is monopolized by the Governments of the States mentioned. The salt is exposed to the sun and hardened; at first it is of a reddish hue, but afterwards becomes clear. There is a town called Sámbhar on the south bank of the lake. There are three kinds of salt which come from Jaipúr—the Sámbhar, the Dindó, and the Réwassa, they sell at 16 seers, 24 seers, and one maund per rupee, respectively.

As before remarked the salt called Sámbhar is manufactured from some brine wells as well as the lake, but it is only in certain places that the brine occurs. Sámbhar salt is the most esteemed of all the evaporated salts; similar salt, but rather inferior in quality, is made at Dindesána in Jodhpúr. The great mart for both kinds is at Bhawání, in the Hissar district.

SALTPETRE.

Saltpetre, "shora," is a nitrate of potash, ($KONO_5$,) which is found naturally in the soil in many parts of the Punjab, efflorescing near old buildings. It is not to be confused, however, with the white efflorescence often observed on the "Reh," or barren uncultivated lands, and which is usually a sulphate of soda.

Saltpetre is obtained by evaporation from water, in which has been thrown earth containing the crude salt; it is refined by further boiling and evaporation.

The purest kind (when it is allowed to crystallize carefully in six-sided prisms,) is called "shora kalmi," the long thin crystal being likened to the pen reed, or "kalam."

Saltpetre is manufactured in two methods: 1st, by boiling; the other by evaporating in shallow basins, termed "ágar." The boiling pans pay Rs. 2 a year, as their tax; the ágars, Rs. 3. The whole number of pans in the Punjab appears to be 4,200, and 20 ágars. The annual yield of the pans is variously estimated at from 100 maunds in Hissar to 35 maunds in Múltán, but this latter is much too low. The chief expense of preparation is in fuel and wages of workpeople. In Sealkot it is calculated the profit to the maker is about 65 per cent. on his outlay. Mr. Roberts thinks this about the average of the whole province.*

In 1858, 1,96,000 maunds were produced in the Shahpúr district from 2,279 pans.† It appears that a very large quantity of saltpetre (amounting in one year to 9,000 maunds from the Dera Ghází Khán district alone) was imported to Sindh, where it is refined; and the impression was (though it was not altogether correct) that the alimentary salt extracted in the process was sold free of duty to the detriment of the revenue.

The following Table shows the number of saltpetre pans at work in the several districts of the Province:—

Division.	Number of pans.		Remarks as to the use of "agars."
Lahore,	Lahore,	58	None.
	Gújranwalla,	40	
	Firozpúr,	60	
Delhi,	Delhi,	9	7 in Delhi.
	Karnál,	4	
	Gurgaon,	48	
Múltán,	Múltán,	140	None.
	Jhung,	94	
	Gugaira,	67	
Amritsar,	Gurdaspúr,	52	Ditto.
	Sealkot,	8	
	Amritsar,	0	
Hissar,	Jhajjar,	0	4 exist.
	Sirsa,	0	
	Hissar,	201	
	Rohtak,	181	

* Mr. Roberts' Letter to Government, 18th October, 1859.

† The revenue realized from these pans was in 1861 Rs. 5,544.

Division.	Number of pans.	Remarks as to the use of "agars."
Deraját,	Leia (Bunnoo), 127 D. I. Khán, 201 D. G. Khán, 166	None.
Peshawur,	Peshawur, 7 Hazára, 8 Kuhát, 0	Manufacture is very small.
Ambálah,	Ambálah, 14 Thanesar, 48 Ludhiana, 38 Simla, 0	Only in Ambálah.
Jálandhar,	Jálandhar, 61 Hushyarpúr, 41 Kangra, 0	None.
Total,	1,585	Only a few, about 20.

The following account of saltpetre appeared in the "Lahore Chronicle," on the 12th May, 1855, by Mr. Gardener.

"During the Sikh reign, saltpetre was produced in a quantity merely sufficient to supply local demand. Then Government was the chief purchaser, and it was freely sold at from nine to sixteen annas per maund of about 100 to 112 lbs. weight. It was usually of a coarse quality, either unwashed altogether, or but partially so; whenever required by the Government for the manufacture of gunpowder, it had to be purified by the European officers then in charge of such works.

"After the annexation of the Punjab, small factories were first erected in the Jálandhur Doab and Cis-Sutlej states, with a view to exportation, *viá* the Sutlej and Indus, to the Bombay and European markets. Subsequently in 1850, a considerable number of factories were established in the Múltán and adjoining districts, and lastly, in Sindh.

"The trade is still in its infancy, and should it receive the impulse of European capital and energy, the Punjab is capable of producing from 4 to 5,000 tons yearly of this useful and necessary article, which would realize somewhat about 70,000 to £1,10,000 annually in the London market."

The mode of extracting the saltpetre in the upper part of the Punjab, is usually as follows :—

"The surface of the soil is scraped off with a small spade, (called kai or kódar) to the depth of an inch or two, and collected into conical piles or heaps from two to four feet high, which are afterwards removed sometimes four to six miles, to attain a locality where fuel and water may be convenient; there the process of accumulation proceeds, affording employment to both the male and female members of numerous families, until a sufficient quantity of the earth is procured, to insure to them the manufacture of saltpetre, at least for a season, or say five or six months. These people are generally solely dependant on this article for their subsistence. The accumulated earth is their whole stock in trade; it is usually left exposed to the full action of the weather without, however, any perceptible detriment or change. The process of extracting the saltpetre next ensues. Large mouthed earthen vessels of the form of those used on the Persian wheel are placed on an earthen tripod, each vessel having a small aperture at its bottom; first a layer of straw and then of woodash is introduced, and on this the saltpetre earth is loosely placed to within a few inches of the mouth of the vessel. The straw acts as a filter, and no doubt, experience has taught them the chemical and neutralizing property of the potass contained in the woodash; a line of such vessels is erected, with earthen empty cups beneath the orifice of each vessel, to receive the dripping liquid, the earth in the pot being kept well saturated with water until the whole of the saline matter contained in it, is pretty well carried off. This simple, though wearisome, operation, is continued day and night, to ensure a sufficient supply or quantity of the mother liquor for daily operations. This liquid usually contains but from two to five per cent. by weight of the required article. Oval iron pans, from one to two feet diameter and six to nine inches in depth are next filled with the liquid; and heat being applied, evaporation commences; the diminishing quantity of liquid being from time to time replenished by additional supplies. This part of the process requires care and experience, and occupies from twelve to eighteen hours of continued labor. The impurities as they rise, are carefully skimmed off the surface of the boiling liquid, from which, on attaining a certain degree of concentration, the impure salt and other foreign matters are copiously precipitated.

This results from the muriate of soda, or properly speaking, the chloride of sodium, being equally soluble in cold as in hot water. The filthy sediment is scooped out of the bottom of the pan at intervals, and heaped by the side of the boiler. The small pan in the upper Punjab, after thirty to thirty-six hours' continued labor, usually yields 8 to 16 lbs. saltpetre, while the larger pans, of the lower country, in the same time will yield from 15 to 30 lbs., the average yield being the medium figures of each. The quantity and even quality depend on the nature and richness of the earth used.

The soil of the lower part of the Punjab, contains

a much stronger impregnation of common salt than the upper. A line drawn from Pind, Dádan Khán or from Kálábágh eastwards to Pakpatan on the Sutlej, would pretty well define the line of difference.

The following is the average cost at present of one bag of saltpetre, weighing 164 lbs. at the Chinyot factory (taken as a central position), and exported *viá* the Indus to Bombay, and by a comparison with other countries, may give an idea of its future expectations and commercial importance.

	RS.	A.	P.
Prime cost of 164 lbs. saltpetre at the factory, ...	3	0	0
Salaries and expenses to the factors, per bag, ...	0	12¾	0
Cost of empty bag at Múltán, ...	0	6	0
Carriage of ditto to Chinyot factory, ...	0	1	0
Weighing, package and twine, &c.,	0	1	0
Carriage of full bag from the factory to the river bank, ...	0	1	0
Freight of ditto by river boat to Múltán at 2 annas per maund of 82 lbs. each, ...	0	4	0
Agent's and servant's salary, Kosids and hoondee expenses, ...	1	0	0
Interest on total outlay at 9 per cent. per annum, ...	0	8	0
Government license tax, ...	0	1	6
Total cost at Múltán ghát, ...	6	2	6
Freight of steamer, from Múltán to Karáchi, ...	1	4	0
Transfer to the sea-going steamer at ditto, ...	0	2	0
Freight of ditto, to Bombay at Rs. 10 per ton, ...	1	2	0
Commission of agency and servants at Sakar Barí and Karáchí, ...	0	1	6
Landing at Bombay and conveyance to stores, ...	0	2	0
Bombay agency and servants at 2½ per cent. commission, ...	0	4	0
Insurance risk from Chinyot to Bombay,...	0	8	0
Bombay warehouse rent, and fire insurance, ...	0	2	0
Total cost delivered at Bombay,	9	12	0
Price of good saltpetre (at a brisk demand) at Bombay, ...	10	8	0
Supposed profit per bag, ...	0	12	0

A great discussion arose at one time as to the possibility of eliminating alimentary salt during the manufacture of saltpetre, and fears were entertained lest the manufacture, duty free, of this salt should injure the revenue derived from the Government monopoly of the salt mines and salt pans; but it appears that only an inferior salt can be produced, although certainly the manufacture has been practised. The manufacture of saltpetre has been subjected to a license. Act XXXI. of 1861, in Sections 5 and 6 contains provisions subjecting salt educed, whether purified or not, to the full duty, and prohibiting its manufacture otherwise.

The coarse kind of salt, alluded to, is called "kalri lún," or "nimak shor."

Previous to annexation, it was made by a class of people called "monars," or "lúngars," and was used by the poorer classes. The salt was also used, and still is, for preserving hides, tanning leather, cleansing rice, or as a stimulant for cattle, and particularly camels. It may be purchased at any druggists. The following particulars will serve to show what proportion of alimentary salt there is in saltpetre earth.

They are derived from a statement of the results of an analysis of thirty-two samples of saltpetre, received from the Múltán division, made by Mr. Hickie in 1859.

		Per cent.
No. $\frac{1}{297}$.	Sample of bad saltpetre, from the Shahpúr district, containing common salt, ...	32·88
No. $\frac{2}{298}$.	Ditto, ditto, ditto,	33·70
No. $\frac{3}{299}$.	Ditto, ditto, ditto,	43·56
No. $\frac{4}{300}$.	Ditto, ditto, ditto,	35·34
No. $\frac{5}{301}$.	Ditto, ditto, ditto,	62·47
No. $\frac{6}{302}$.	Ditto, ditto. ditto,	46·85
No. $\frac{7}{303}$.	Ditto, ditto, ditto,	42·74
No. $\frac{8}{304}$.	Ditto, ditto, ditto,	43·56
No. $\frac{9}{305}$.	Ditto, ditto, ditto,	28·77
No. $\frac{10}{306}$.	Ditto, ditto, ditto,	30·41
No. $\frac{11}{307}$.	Saltpetre, 2nd quality, Shahpúr district, containing common salt,...	19·73
No. $\frac{12}{308}$.	Ditto, ditto, ditto,	25·48

per cent.

No. $\frac{13}{309}$. Saltpetre, 1st quality, Shahpúr district, containing common salt, ... 9·04

No. $\frac{14}{310}$. Ditto, ditto, ditto, 9·86

No. $\frac{15}{311}$. Ditto, ditto, ditto, 9·86

No. $\frac{16}{312}$. Ditto, ditto, ditto, 15·62

No. $\frac{17}{313}$. From Serai Sidhú, zillah Gugaira, saltpetre, 2nd quality, containing common salt, 9·86

No. $\frac{18}{314}$. From Serai Sidhú, saltpetre, 3rd quality, containing common salt, ... 18·08

No. $\frac{19}{315}$. From Serai Sidhú, saltpetre, 1st quality, containing common salt, ... 3·28

No. $\frac{20}{316}$. Múltán district, saltpetre, 3rd quality, containing common salt, ... 5·75

No. $\frac{21}{317}$. Gugaira district, saltpetre, 2nd quality, containing common salt,... ... 5·76

No. $\frac{22}{318}$. Ditto, ditto, saltpetre, 3rd quality, containing common salt, ... 11·50

No. $\frac{23}{319}$. From Lodran, Múltán district, saltpetre, 1st quality, containing common salt, a trace

No. $\frac{24}{320}$. From Mylree, ditto, ditto, saltpetre, 3rd quality, containing common salt, 75·62

No. $\frac{25}{321}$. Múltán district, saltpetre, 1st quality, containing common salt, ... 36·17

No. $\frac{26}{322}$. Jhung district, saltpetre, 2nd quality, containing common salt, ... 17·26

No. $\frac{27}{323}$. Gugaira district, saltpetre, 3rd quality, containing common salt,... ... 8·22

No. $\frac{28}{324}$. Gugaira district, saltpetre, 1st quality, common salt, ... a trace

No. $\frac{29}{325}$. Múltán district, saltpetre, 2nd quality, containing common salt, ... 11·51

No. $\frac{30}{326}$. Ditto, ditto, saltpetre, 3rd quality, containing common salt, ... 16·44

No. $\frac{31}{327}$. Jhung district, saltpetre, 1st quality, common salt, ... a trace

No. $\frac{32}{328}$. From Lodran, Múltán district, saltpetre, 2nd quality, containing common salt, 2·40

In the saltpetre factory of Fattihpúr, Múltán, a boiler 44 inches in diameter and 15 inches depth in the centre, produced 18 seers of saltpetre and 22½ seers of salt, the proportion being 10 chitacks of salt to a half seer of saltpetre.

Mr. Wright is of opinion that three-fourths of the salt produced in the manufacture of saltpetre might be converted into alimentary salt. Dr. Brown, Chemical Examiner, states that on analysis, the saline matter contains four-fifths, *i. e.*, 8 per cent. of chloride of sodium (culinary salt) with some chloride of potassium, some sulphate of soda, a little lime, and nitrate of potash.

He is of opinion that it might be used as alimentary salt, particularly if re-crystallized, but that its continued use would be liable to produce diarrhœa.

I now proceed to detail the various methods of manufacture of saltpetre, as practised in different districts, and begin with Múltán.

The nitrous earth is first soaked through a filter, after which the liquid is taken in earthen pots from the reservoir into which it has run, and put into an iron pan, in which it boils from 20 to 24 hours: when it has attained a consistency, the liquid is put in a vat, where it is allowed to cool and settle for the night. In the morning the nitrous substance is taken out in the form of small crystals, and is washed in a woollen cloth, in which it is then tied and exposed to the heat of the sun till the water has been absorbed.

The filter is built on an incline; it is formed of mud walls on three sides, one side being left open for the passage of the liquid to the reservoir, and is covered in with reeds (kurrees) upon which the earth to be treated is spread. The reservoir for receiving the liquid from the filter is made of pucka masonry, as is also the vat in which it is cooled after boiling. The pan is made of iron, and the grate of earth. The vernacular names are as follows:—

Filter,	equivalent,	Manní,
Reservoir,	"	Toa,
Vat,	"	Kunálí,
Pan,	"	Karáhí,
Grate,	"	Chúla.

Saltpetre can be obtained from the soil in many parts of this division, but the most favorable spots for its production are old mounds "blurs," as they are termed there, (equivalent to the T'hé or Dhí, of the Cis-Sutlej,) which are sites of former villages or forts, and in which nature has for centuries been carrying on a process similar to what manufacturers adopt where they heap up the nitrous earth, wood ashes, and animal matter.

From the Gujrát district the following account has been obtained.*

The locale of manufacture is as follows:—

	Pans.
In Tahsil Phalia, adjoining the Shahpur district, ...	160
In Tahsil Kharrian, ...	29
In Tahsil Gujrát, ...	15
Total, ..	204

"I am informed that the simultaneous production of salt depends upon the nature of the soil, and that although in the Jhung, Múltán and Gugaira dis-

* By Capt. Hector Mackenzie, formerly Deputy Commissioner.

tricts, salt is thus produced, being precipitated to the bottom of the pan along with other sediment during the process of manufacture, in this district no such result ensues. A sediment more or less foul, and amounting to about one-tenth of the whole produce of the pan does certainly form, but there is so little salt in it, and that little so impure and acrid, and rock salt so cheap from proximity to the mines, that it is not worth while to extract it, nor if extracted would it be fit for the food of man.

"The manufacturers are the poorer Khatris, and Máchís; besides the license fee to Government, they pay to the Zemindars sometimes an anna a day for water supplied from an irrigating well, and sometimes a fee of Rs. 4 for the season, more or less, for the use of the soil. Four or five men working at one pan turn out from 20 to 25 maunds per month. They carry on their work during all the dry months of the year. The out-turn of season 1857-58, in this district, *i. e.*, from the close of the rains of 1857 to their commencement in 1858, may therefore amount to 5,500 maunds, or nearly 200 tons.

"The price of the saltpetre at the manufactories is at present Rs. 3, per maund of 40 seers. It varies from Rs. 2 to 4 according to the demand.

"The produce of the pans in this district is for the most part made to the order of the Pind Dádan Khán merchants. It is by them exported to Múltán and other chief marts. It is coarse and impure as it issues from the pans, but undergoes refinement after export."

The mode of manufacture in the district is as follows :—

"The earth in which it is found is collected and placed on a flat filter made of twigs and supported on pillars 3 or 4 feet high; water is then poured over this layer of earth which dissolves the salt. The solution as it passes through is collected in a vessel placed underneath, having been made previously to filter through an intermediate sheet of cloth which retains the undissolved impurities. The solution is then evaporated to about one-fourth its bulk by boiling, after which, on cooling, the nitre crystallizes. In this impure state it is used for frigorific purposes. Its value is Rs. 3 a maund. Purified nitre, "shora kalmi," is produced by dissolving, filtering, and recrystallizing the impure article; when pure it is used for gunpowder, &c., and values Rs. 8 a maund."

From Amritsar the following account has been received. "Saltpetre is prepared in Ajnálah during the months o October and November. The following is the process of manufacturing it from a species of earth called *kallar.*

"A row of perpendicular posts, each two cubits long, stuck at the distance of a foot from each other is erected, and parallel to it, another row of posts is placed at a distance of three cubits; a cloth strainer is stretched over the posts and attached to each of them. A stick is then placed breadthwise over each of the two parallel opposite posts, which acts as beams do in a pucka house. Over these sticks are placed twigs of the *kuppás* tree (cotton plant?) The thatching thus prepared is littered with grass an inch deep which acts as a filter, and over this is deposited 25 maunds of the kallar, so thoroughly saturated as to allow the water to pass through the cloth strainer into the receiver or troughs placed underneath; these troughs are not removed before they have stood 9 hours under the strainer. If there is yet some saline matter in the earth, a little water is sprinkled over it and the troughs placed again under the strainer to catch the drippings. The water thus accumulated is boiled in a caldron for 8 or 9 hours, or till such time as there is an apparent change in the color of the water from muddy gray to deep red. The caldron is then removed and its contents allowed to cool. A little after midnight the boiled salt water is stirred up with a wooden ladle and laid out in the open air in small earthen plates. In the morning the plates are removed and the water having been quietly poured off, the deposit is saltpetre. To refine it again, the boiling process must be repeated."

The process followed in the Hushyarpúr district is somewhat different from the foregoing.

"The earth, in which saltpetre is known to exist, is collected in heaps, and small *gharras* (earthen pots) are filled with it. These are put upon a stand made of earth, of a height sufficient to allow of a "tind," another description of earthen pot, being put *under* the first named "ghurra." The upper vessel has a hole in the bottom, and water being poured into it, on the top of the earth already there, it is allowed to trickle down through the hole in the bottom; the water thus filtered through, is then boiled in a "karáha," a large iron vessel, and the scum as it comes to the top is removed. After being thoroughly boiled, it is gently poured out into large pans, in which it gradually crystallizes, and the residue that remains at the bottom of the "karáha" is thrown away, as it is a coarse species of salt which is contraband.

"The evaporation system consists in putting the earth into a small pucka tank, to the depth of about an inch, in which water is poured, perhaps two inches deep: this is allowed to stand a day or two and then a plug from the bottom being withdrawn, the liquid is allowed to run off into another small tank, where it crystallizes; the water being evaporated by the sun's rays."

The exhibited samples are as follows—

386.—[522]. Saltpetre, from Shorkót. DEPUTY COMMISSIONER OF JHUNG.
Jhung.

387.—[571]. Saltpetre, "khorah," from the Yusufzai. Value, Rs. 6 per maund. LOCAL COMMITTEE.
Peshawur.

388.—[572]. Saltpetre in crystals (shora kalmi), prepared by KHANAN KHAN, Peshawur. LOCAL EXHIBITION COMMITTEE.

Value, Rs. 13 per maund; used in medicine, and for gunpowder and fire-works.

389.—[122]. Large crystals of saltpetre. DEPUTY COMMISSIONER.
Gurgaon.

390.—[620]. Saltpetre, crude. RAJAH OF JHIND.
Jhind.

391.—[621]. Saltpetre, refined.

Saltpetre is also exhibited from Kapúrthalla (623), Gujranwalla (435), Fatihabad, the Hissar district (499), Rohtak (702), Ambálla (704), Ludhiana (709), Jálandhar (726), Amritsar (purified sample) (757), with raw and refined from Phaliyan of Gujrát, from Harapá in Gugaira (918), from Dera Ismail Khán (927), and the higher Hills in the Dera Ghází Khán district (928), also from Mithankót, and Dera Ghází Khán itself (930-931). Saltpetre is produced at Dera Ghází Khán, as stated by Major (then Lieut.) Pollock, at the rate of 8,000 maunds per annum, and the manufacture had increased considerably in 1853. The amount of duty realized by a tax of Rs. 2 per vessel or "karáwá," gave only Rs. 404. In 1854, contracts were given out for each Tahsil, and the aggregate realized was 1,787 Rs., or an increase of 300 per cent.; in 1859, it had not risen any further.

From Shahpúr, saltpetre is exhibited. It is found throughout the "Bar," especially on the sites of ancient towns or villages: Rs. 2 a maund, is its value there.

ALUM.

Both native and European alum are met with, the latter being white in color and quite pure, on which account it is preferred in medicine. Alum is manufactured in considerable quantities at Kálábágh and Kutkí, whence it is exported to all parts of the Punjab and upper India. The white alum is principally imported; it is used for sore eyes, in some kinds of opthalmia; and the sample called "phullá fatkari," from Bunnoo, is noted as being invaluable for wounds and bruises. The chief value of alum is as a brightener and mordant in dyeing, particularly with madder.

The alum made at Kálábágh, is always of a pinkish color, which arises from chloride of iron. It is remarkable also that the alkaline base of Kálábágh alum is soda, while that of English alum is potash, and in some foreign alums, is ammonia.

Bituminous shale, yielding more or less alum, is abundant all through the Salt range, for although the manufacture is confined to the two places—Kálábágh on the river bank, and Kutkí in the Trans-Indus portion of the Salt range, there called the Chichalli hills—it is exported to all parts of the Punjab and Hindústán, being shipped from 'Isakhail to the southern districts of Dera Ismail Khán and Dera Ghází Khán.

At Kálábágh the principal place of working is at Chátah, where the shale strata, called "rol," are nearly 200 feet thick. Shafts for excavation of the shale are sunk, some of them have been measured, and one was found by Dr. Fleming in 1848, to extend 207 feet from the entrance. The shales are very soft, and often the roofs of the excavated portions give way, no precautions being taken to prop the roof when the underlying matter has been removed. The shales have been known spontaneously to take fire in the shafts; and Dr. Fleming relates that smoke was constantly issuing from one of these, which had taken fire five or six years previous to his visit in 1848. This is owing to the decomposition of iron pyrites, or sulphuret of iron, which abounds in crystalline nodules throughout the shale. The shale when dug out, is loaded on bullocks in the common blanket sacks everywhere in use. The road descends by a steep path to the bed of the Sind nullah, and thence to Kálábágh along the banks of the Indus. At the alum kilns of

Kálábágh the shale varies in value from 14 to 17 maunds per rupee. The red mound-like kilns form a striking feature at Kálábágh; the fumes from them are said to be very unwholesome, the population is sickly, and goitre very common, though it is not attributable with any certainty to this cause.

In making an alum kiln, layers of brush-wood, generally "jhau" or "pilchi" (*Tamarix*), which abounds on the banks of the river, are spread on the ground; then a layer of alum shale is laid upon them, then more brushwood, and so on, till the pile reaches a very great height, from 20 to even 60 feet high; the half formed pile is lighted first, and the combustion moderated by sprinkling water if necessary; subsequently more layers of shale and brushwood are added till the whole reaches the height mentioned. A pile takes 6 or 8 months to burn, and by the time the operation is complete, the heaps have acquired a brick red color, due to per-oxidated iron, and its surface is covered with an efflorescence of alum, containing a quantity of sulphate of iron—kahi or kasís.

The calcined shale is next lixiviated with water in large and somewhat shallow tanks of baked earth about 12 feet square and 18 inches deep. When the soluble matter of the shale is dissolved, the liquid is allowed to flow off by a hole (plugged up during the first process) into a similar tank at a lower level. In this the liquor deposits by subsidence its mud and impurities, and again is drawn off into a third vat, lower down still. It is then poured into iron evaporating pans, and mixed with a dirty looking salt, called "jamsan," from which it derives an alkali which converts it into the alum of commerce. "Jamsan" appears to be similar to the saline efflorescence of Reh lands, and consists of sulphate of soda with a little common salt, and a very little carbonate of soda. Jamsan is obtained at Kálábágh by evaporating a solution of the "kalr" soil, collected in the jungles east of the Indus, and specially at two villages—Gari and Tatti—up the south side of the Salt range, eight or nine miles from the river.

The quantity of the salt which is proper to be added, is judged from the appearance of the mother liquor. When the mixture has settled, the alum solution appears as a clear brown fluid, which is drawn off to evaporate in vats under a shed. In these, as evaporation proceeds, the alum is formed in crystals of a pink color, the color being derived probably from the salts of iron contained in the liquid. When the crystals have formed in considerable quantities, they are removed and washed slightly with cold water on strainers of "sírki" grass and left to dry; after which they are heated to fusion in iron pans, in which they liquefy by their own water of crystallization. This liquid is poured into earthen gharras or jars, and left to cool and crystallize; when the process is complete, any water that remains is poured out of the crystalline mass by boring a hole in its surface; the ghurra is then broken, and its contents broken into lumps, these form the alum of commerce. It appears that the inhabitants of Kálábágh have for many generations carried on this trade and manufacture, the process of which differs very little from the European.

At Kutkí, across the Indus, in the Chichalli range, there are opposition alum works. They are owned by a company of eight members, who are residents of 'Isakhail, and are of much more recent date than the Kálábágh works, which have gone on for eight or nine generations; the materials at Kutkí are obtained at a much cheaper rate.

At Kálábágh, the cost per diem of keeping one "karáh" or evaporating pan, including cost of shale and fuel, and the fees paid to the Malik of Kálábágh, is Rs. 10-4-6.

At Kutkí, the shale is cheaper and the fees are lower, there being only one for water-right payable to the Lumberdars of 'Isakhail; the cost is therefore only Rs. 8-10 per diem, a circumstance likely to affect the Kálábágh

monopoly. Some jealousy it is said exists between the new and old works.

At Kutkí, about 10,000 maunds are annually produced. At Kálábágh, about 12,000, during the 10 months of the year for which they are worked.

Kálábágh alum sells at Rs 3-4 a maund on the spot; Kutkí alum at Rs. 2-8; there is no difference in the quality, but the expense of making it at Kutkí is less.

392.—[905] Alum shale, from near Kálábágh, and found throughout the Salt range. Mr. Mathews.

Shahpur.

393.—[906]. Alum extracted from it.

The shale contains alumina, silica, carbonaceous matter, and some sulphate of iron.

394.—[934]. Alum from Geandari hills. Municipal Committee.

Dera Ghazi Khan.

395.—[935]. Another sample, by Imam Baksh Khan.

396.—[936]. Alum earth (shale), from the same.

397.—[955]. Black earth, "rol," used in the manufacture of alum.

Bunnoo.

398.—[954-5]. Purified alum, from Kálábágh. Deputy Commissioner.

The value of this alum is about Rs. 10 a maund.

399.—[579]. Red alum, Kálábágh.

Peshawur.

400.—[956]. White alum, Kálábágh.

401.—[630]. Alum, from Singhánâ.

Gurgaon.

Probably from a shale containing sulphate of iron and alumina.

402.—[298]. "Murbo" (Murabbah).

Lahaul.

This is a compound of alum with mica, used as a mordant for the yellow dye of nayálú (*see* Class IV., Sub-Class (C), *ad loc.*)

403.—[319]. "Pasút."

This is a compound of alum with some gray slate, in small fragments used in dying black.

SAJJI OR BARILLA.

This is an impure carbonate of soda, prepared by burning plants of the *Salsola* and other species, and collecting the ashes, which melt into a dark colored mass. "Sajji lota" is a somewhat purer kind, but still contains an immense amount of organic and other foreign matter, such as the sulphates of soda and lime, chloride of sodium and potassium, sulphide of sodium, sulpho-cyanide and ferro-cyanide of sodium, together with silica and clay.

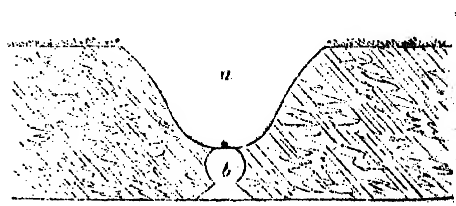
The principal places of production are—Gugaira, Sirsa and Jhung.

The following account of the manufacture of sajji has been received from Gugaira.

Sajji is produced from two different plants which grow spontaneously in brackish soil in the bar tracts of the Bari and Richnab Doabs, called "kangan khár" "láná gora," and "phisak láná," the last two yielding inferior, and first superior, sajji.

The "kangan khár" plant yields the best alkali. The pure sajji from this plant is called "lotá sajji," and the residue mixed with ashes is called "kangan khár sajji." The other two plants yield only a dirty and inferior substance known as "bhútni sajji," "devil's soda." This is black in color, and sold in pieces like lumps of ashes.

The process is as follows:—The shrubs ripen about October, and the process of making sajji is carried on throughout October, November, December and January. The first step is to cut down the plants with a wooden scythe called "*talwár.*" They are then allowed to lie on the ground in heaps to dry. When perfectly inflammable, a pit in the ground is dug in



a hemispherical shape, about 6 feet in circumference and 3 deep, at the bottom of which one or more inverted "tinds," or earthen vessels, are buried, having small holes pierced in their upper portions; the holes are kept closed at the commencement of operations.

A fire is kindled and the dry plants placed in the

space (*a*) with the aid of a "sângi," or pitch fork, and the fire is kept fed with the dry plants till all is burned; during the process of burning a liquid substance is formed, which runs down into the "tind" below the fire. After all the liquid has run through with the "tind" the residue is stirred up with a stick called "mashad," which has a round flat piece of wood at the end, like a ladle, or with a "ghorla," *i. e.*, a piece of wood cut green from the tree to prevent its burning. Great care must be taken during the above process, that no water is allowed to be put on the fire, otherwise the whole mass would blow up and endanger the lives of those manufacturing it. After the residuary mass has been stirred in the manner described it is covered over with earth; it cools in 3 or 4 days but can be taken out when wanted.

The "*bhútni*" sajji is made in the same manner as the above, but from the shrub called "phisak láná." When the earth is removed the substance is found in a solid rocky state, it is then broken out with a tool called "wadam," or wooden crow-bar. Then the "tinds" that are underneath are also removed, and being broken the contents are taken out.

The residuary mass in the pit is crude dirty potash, but that which is found inside the "tinds" is clean and free from ashes, &c., &c., it is called lota sajji, because found in the "tind" or "lota."

The proportion produced of kangan and bhútni sajji is four seers from a maund of the plant, or one tenth; and of the lota sajji, one seer in a maund, or $\frac{1}{40}$th part.

There is no rateable tax on sajji. The land producing the plants, is leased out in plots or according to Tahsil jurisdiction. The average of the last five years will be found below, the yield of each Tahsil is not shown. The quantity of sajji manufactured in the district is not large, the plants being exceedingly valued by contractors for feeding their camels.

Name of Tahsil.	Sum for which leased.
	RS.
Gugaira, ...	940
Hujra, ...	794
Pák Patan, ...	4,056
Syadwala, ...	..
Harrappa, ...	2,095
Total, 5 years, ..	7,885
Average, ..	1577

The original price being 4 as., 5 as. is added for the Government rent and fees; a maund thus costs from 9 to 10 as., on the spot; but the market price is from Rs. 1 to 1-8 per maund. Lota sajji commands a much higher price, and sells at Rs. 8 a maund.

The expense attending the manufacture, viz., cutting, stacking, and lifting, is about 4 as., per maund.

The workmen who cut the plants get 2 as., a day, the burners take 3 as., and there is one man to superintend.

Lota sajji is principally used as a medicine, on account of its high price.

Kangan khár sajji is used in washing and dyeing with madder and kasumbha; it is used also for making soap, and also in the process of purifying sugar, and in paper making.

The castes principally employed in the manufacture of sajji are chúras, dhobis, núnáris, and a few aróras; but there is no necessary distinction or superstition on the point.

The following is an account of the manufacture in Sirsa.

Sajji, which is a preparation from a plant bearing the same name, is of three qualites.*

The first is called the "chúwa," the second "búthá," and the third "khára." All three qualities are produced at the same time, and by essentially the same process of manufacture.

The plant is cut during the months of October, November, December and January. When cut, it is allowed to dry for twenty days. The process of burning is just the same as that already described. Into the pit is thrown a small quantity of the plant, and burnt, fresh plants being gradually added to keep up a constant fire; and this is continued till the pit fills up. During this process a liquid matter exudes from the plant. As soon as this is observed the orifice of the ghurra is opened, and then the liquid matter and ashes are stirred up together. A long stick, very pointed at the end, is held in the opening of the ghurra, to prevent the sajji inside from being contaminated with ashes. The alkali found in the ghurra on cooling is called the chúwa, or first quality sajji; that which remains over the pot and under the ashes is the búthá, or second quality; and that on the surface of the pit, is the khára sajji, or third quality.

The plant comes into blossom about the month of September, and is burnt when in flower. It is *sup-*

* Memorandum by Captain E. Robinson, Superintendent of Bhutteeana, regarding the sajji plant, and the preparation of alkali therefrom.

posed that the liquid which forms the sajji of the first quality is the produce of the flowers.

The plant springs up spontaneously, and thrives best on a hard and clayey soil. The stems that have been cut away shoot out again in the rains, and by the cold season are again ready for cutting. They grow to a height of 10 inches.

The plant is peculiarly susceptible to the influence of the winter rains; and previous to manufacturing, if it is at all affected by the rains, the quality is generally deteriorated, and the yield from it is by no means remunerative.

Another precaution necessary, is to cut a sufficient quantity of plant; for, if during the burning process the supply should fail, and the fire be extinguished before the pit has filled, all the labor is lost.

The quantity of plant (when in its green state) required for one pit, is estimated at from 20 to 25 maunds.

Sajji is very extensively used in washing and dyeing cloth. It is also applied to injuries sustained by camels and horses,* and I believe it is used to clarify sugar. The sajji of the first quality, or cháwa sajji, is of a light red color, and sells at the rate of Rs. 2 per maund. The second, or báthá sajji, is of a dark-grayish color, and sells at Rs. 1-8 per maund; the third quality, or khára sajji, is of a blackish color, and sells at Rs. 0-8-6 per maund.

The traffic in this article at times is very great, and large quantities are exported to Europe (?)

Mr. Edgeworth (then Commissioner of Múltán) gives the following account of the sajji plants.

"The sajji is exactly the barilla of commerce, a carbonate of soda. It is produced in Spain from a plant extremely similar to that from which it is made here.† The latter is termed in this division "khár," or in Persian "ash khar." The scientific name is, *Coronylon Griffithii.*

"A similar species is cultivated in Spain extensively; and as the price in England is from £9 to £12 per ton, I have little doubt that it could be most profitably cultivated in the bare wastes of clay, otherwise absolutely profitless, so extensive both in Bhutteana, Sirsa, and the Punjab.

"I have heard the plant producing the sajji called (by Europeans) "lahna," and I once made the same error myself; but the natives carefully distinguish between them, calling by the names of white, and red lahna and lahni, other *salsolaceous* plants, which are not used in the manufacture of sajji, though I have little doubt that with proper manipulation, they too, especially the lahni (*suæda molliflora*) would produce barilla.* There are many square miles densely covered with this last; whereas the khár is comparatively rare. Camels are ravenously fond of the latter, and the great difficulty in the "bar," or desert, is to keep the camels from destroying it. Large quantities are brought in green to the Múltán market for fodder."

404.—[581]. Crude soda, "skár," from Yusufzai. LOCAL COMMITTEE.
Peshawur.

Used for soap making, &c. Value Rs. 3 per maund.

405.—[167]. Five specimens, showing the sajji in its various qualities. LOCAL EXHIBITION COMMITTEE.
Sirsa.

Black sajji, cháwah sajji, sajji phúl, and two others, báthá and khára.

When the pit in which the sajji has been prepared is opened, on completion of the process there are no ashes or residue found, but the alkali appears like glass sparkling in masses. To every quarter seer of first-class sajji there is 1 seer of second quality, and 1¼ of the third. Sajji is made at the following places:—At Tahsil Sirsa, village Shekhopúr, now called Sadowála, and Hásilpúr, 20 maunds; but now the "bangur" land is so much brought under cultivation that the spontaneous production of the sajji plant has much diminished.

				maunds.
Tahsil Sadowála, village	Chutalla,		...	50
"	"	Motígarh,	...	75
"	"	Sujángarh,	...	75
"	"	Berangarh,	...	10
"	"	Marindwala,	...	100
"	"	Rajpura,	...	10
"	"	Gokháñwali,	...	20
"	"	Garhwálí,	...	5
		Total,	...	375

In Tahsil Fazilka, it is made at Shankargarh, Abúhar, Azimgarh, Alámgarh, Dharmpúra, Pattiwálá, Kamálwálá, Tútwálá, Pajáwah, Gamjál, Kotligárh, Usmángarh, Giddránwálí, Ahmádpúr, Amrpúr,

† Barilla or Barillor. In various parts of Europe, especially in the Spanish seaports and at Teneriffe, a fine soda is manufactured by burning some varieties of plants which grow near the sea coast, especially the *salsola soda* and *salicornia herbacea*. The soda thus procured is called barilla, and still constitutes an important item in British trade. It is imported in hard porous masses of a speckled brown color.

* No doubt "láni" and "lána" are both used in making the *inferior* soda (bhútni sajji) in Gugaira and other places. —B. P.

Dotáránwálí, Senúgéná, Káhián, Faridkot, Bahádargárh, Hattípúr-suránwalí, Armáwálí, Mahmúdgarh, Bakshgarh, Kálábíta, Baháwalbáshi, Gúlábgarh, Pahlogarh, Haripúr, and Daulatpúr. The total produce of these villages is in the aggregate about 1,000 maunds.

Sajji of first quality sells at Rs. 3 per maund; do. of 2nd do. (bút'há chúwa), Rs. 1-8 per maund, do. of 3rd do., Rs. 0-12-0 per maund.

If there is an usually abundant produce, the rates come down to Rs. 2-8, Rs. 1-4 and 10 as., respectively. This year (1864) scarcely any has been made.

406.—[919]. Sajji, value 8 seers per rupee. (920). Kangan khár, value 23 seers per rupee. (921). Bútní, 34 seers per rupee.

Gugaira.

407.—[926]. Potash (properly soda.)

Jhung.

408.—[913]. Impure carbonate of soda, two samples, the sajji and sajji lota. Deputy Commissioner.

Shahpur.

This is manufactured in the "bar" of the tehsil Shahpúr, and also worked in the Salt range; the "sajji lota" is the purer, so called because collected pure during the burning in "lotas." Value, 1-8 per maund.

Sajji also is exhibited from Jálandhar (722); * also from Lahore as a medicinal substance; and from Dera Ghází Khán, (941).

NAUSHADAR.—SAL AMMONIAC.

This important salt (chloride of ammonium) which is met with in every bazar, is manufactured largely in the Kurnál district —Occasionally it is extracted from brick kilns in other districts, but in small quantities. It is used both medicinally and in the arts. The samples exhibited are numerous, but many are not produced in the district whence they are exhibited.

The production of naushádar in brick kilns is probably owing to the decomposition of watery vapours by the red hot bricks in presence of the nitrogen of the air and of common salt, which is purified by sublimation.

It is used as a freezing mixture with nitre and water, and in arts in tinning and soldering metals, and in the operation of forgeing the compound iron used for making gun barrels by native smiths.

It is met with in Europe in the vicinity of burning beds of coal in Scotland and England, and near the volcanos of Vesuvius, Etna, Solfaterra, &c.

409.—[154]. Large mass of naushádar, from Kaithal and Gúla. Local Committee.

Kurnal.

410.—[ ]. Glass vessel used in the manufacture.

Sal ammoniac or naushádar is, and has been, for ages, manufactured by the potters or kúmhárs of the Kaithal and Gúla tahsils of the Kurnál district:—chiefly in the Gúla tahsíl, and more than anywhere else at the village Gúmtallah.

The only village in which it is manufactured in the Kaithal tahsil is Mánus.

The amount of it manufactured annually in the district is estimated as follows:—

Place.	Quantity.	Value.
	Maunds.	Rs.
Kaithal, ...	300	4,500
Gúla, ..	2,000	30,000

It is sold by the potters at 8 as. per maund to the mahájans, who export it to Bhawání, Delhi, Farakábád, Mirzapúr in the N. W. Provinces, and to Fírozpúr and Amritsar in the Punjab, and who also sell it on an average at Rs. 15 per maund.

The salt is procured by submitting refuse matter to sublimation in closed vessels, in the manner described below, which is similar to the Egyptian method.

The process is as follows:—

From 15 to 20,000 bricks made of the dirty clay or mire to be found in certain ponds, are put all round the outside of each brick kiln, which is then heated. When the said bricks are half burnt, there exudes and adheres to them the substance from which naushádar is made; this matter is produced by

* No. 730, called sajji, from Jálandhar, is kahi, sulphate of iron.

the heat of the kiln in the hot weather in three days, in the cold weather in six, in the rains no naushádar is made. On the bricks producing this substance, which is of a grayish color and resembles the bark that grows on trees, they (the bricks) are removed from the kilns, and when cool this crust is removed with an iron scraper or other such instrument; the substance which is thus produced is of two sorts; the first kind which is most abundantly produced, and is inferior, is designated the mittí khám of naushádar, and the yield per kiln containing 15 to 20,000 bricks is about 20 or 30 maunds; it sells at 8 as. per maund; the superior kind which assumes the appearance of the bark of trees, is called "pápri," and the yield of it per kiln containing 15 to 20,000 bricks is not more than 1 or 2 maunds; it is sold at the rate of Rs. 2 or 2¼ per maund. The mahájans who deal in naushádar buy both the sorts above described; but each sort requires special treatment to fit it for the market. The "khám mitti" is first passed through a sieve, and then dissolved in water and allowed to crystallize. This solution is repeated four times to clear away all impurities. When this has been accomplished, the pure substance that remains is boiled for nine hours; by this time the liquid has evaporated and the resulting salt has the appearance of raw sugar. The "pápri" is next taken and pounded finely, after which it is mixed with the first preparation, and the whole is put into a large glass vessel made expressly for the purpose. This vessel is globular or rather pear-shaped, and has a neck 2½ feet long and 9 inches round, which is closed at the mouth, or more properly speaking has no mouth.

The composition to be treated is inserted into this vessel, by breaking a hole in the body of the vessel, just at the lower end of the neck. This hole is eventually closed by placing a piece of glass over it. The whole vessel (which is thin black colored glass) is smeared over with seven successive coatings of clay.

The whole is then placed in a large earthen pan filled with naushádar refuse to keep it firm; the neck of the vessel is further enveloped in a glass cover and plastered with fourteen different coatings of clay to exclude all air, and the whole concern is then placed over a furnace kept lighted for three days and three nights, the cover being removed once every twelve hours in order to insert fresh naushádar in the form of raw sugar, to supply the place of what has been sublimed. After three days and three nights the vessel is taken off the furnace, and when cool, the neck of it is broken off, and the rest of the vessel becomes calcined. 10 or 12 seers, according to the size of the neck of the vessel containing the naushádar is then obtained therefrom, of a substance which is designated "pháli." This pháli is produced by the sublimation of the salt from the body of the vessel, and its condensation in the hollow neck. There are two kinds of "pháli;" the superior kind is that produced after the naushádar had been on the fire for only two days and two nights, in which case the neck is only partially filled with the substance, and the yield is but 5 or 6 seers, and sold at the rate of Rs. 16 per maund; the inferior kind is where the naushádar had been in the fire three days and three nights, and the neck of the vessel is completely filled with pháli, when it yields 10 or 12 seers, and the salt is sold at Rs. 13 per mahnd.

That portion of the sublimed naushádar which is formed in the mouth and not in the neck of the vessel, is distinctively called "phúl," and not phálí; it is used in the preparation of "surma," and is esteemed of great value, selling at Rs 40 per maund.

Each furnace is ordinarily of a size to heat at once seven of these large glass vessels containing naushádar.

The villages in which naushádar is manufactured are as follows:—

Tahsil.	Village.	Number of furnaces for manufacture of naushadar.
Kaithal,	Mánus, ...	4
Gúla,	Gúmtullah, ..	15
,,	Kurrah, ...	1
,,	Siyána Saíñdañ, ..	3
,,	Barna, ...	2
,,	Bindrana, ...	2

411.—[605]. Sal ammoniac, from Yarkand. H. H. The Maharaja.
Kashmir.

412.—[628]. Sal ammoniac, from Firozpúr. Deputy Commissioner.
Gurgaon.

Sal ammoniac is also exhibited from Ludhiana (No. 708), Jálandhar (727 and 735), Amritsar (745), Lahore (854), where it is exhibited as a mineral medicine; also from Gujranwalla (No. 894), and Dera Ghází Khán.

BORAX.

This is a biborate of soda ($N_aO\ 2BO_3 +$ $10\ HO$) called sohága, or "tinkál;" it is ob-

tained in Thibet and in the Pugá valley, in Ladákh.

There it is collected in an impure state on the borders of certain lakes, as they dry up, depositing the salt. The material is smeared with fat to prevent loss by evaporation, and is thus transported across the Himálaya, on the backs of sheep and goats, to the plains, where it is refined by boiling in lime water and evaporating.

It is used in medicine; in the arts, as a glaze for pottery, as also by jewellers to clean gold, silver, &c. A sample of borax has been sent to England. It cost at Kangra, from whence it was sent, Rs. 4 per maund = Rs. 113-2-10 per ton; it was sold at Dundee for £35, say Rs. 350 per ton.

The borax is found at an uninhabited spot, named Pugá, on the Rulangchu, a small stream which is full of hot springs, and which joins the Indus on its left bank, some miles above Lé. Pugá stands in north latitude 33° 12′ and east latitude 78° 16′, at an elevation of 15,264 feet above the sea. The borax is ejected in the bed of the stream by the numerous hot springs at various temperatures, from 80° and upwards.

The borax of Monte Cerboli, in Tuscany, is found also in connection with hot springs, and with sulphur in the immediate neighbourhood. The Pugá hot springs range from 80 to 150°, and there is a sulphur mine on the banks of the stream, and numbers of coarse garnets are found there.

The commercial importance of borax may be inferred from the fact that in England in 1855, a committee of leading men in the pottery and porcelain manufacturing business, forwarded an address to Lord Dalhousie, praying for information as to the possibility of importing borax from the Himálayas and pointing out how essential was borax as a material in the processes of pottery glazing, and how limited it was in the localities of its production.

The following extract will explain the objects of the address, and the necessities that led to it.

The Committee represented as follows:

"*6th.* That boracic acid, is now only obtained from certain springs at the Lagoons in Tuscany, which are under the control of a single proprietor, who has therefore the monopoly of the article.

"*7th.* That about 1,100 tons of boracic acid are annually imported from Tuscany into England, and are there manufactured into borax, of which about two-thirds are consumed in the Staffordshire potteries.

"*8th.* That the supplies of tincal from India appear within the last few years to have varied from 300 to 600 tons, per annum.

"*9th.* That the present price of borax is about £92 per ton, to which it has been raised (under the operation of the existing monopoly), from £50 within the last five years.

"*10th.* That the excessive price materially limits the consumption, and if the article could be purchased at about £60 per ton, there is no doubt the consumption would be doubled.

"*11th.* That an increase in the consumption of borax would greatly diminish the use of lead and other substances, which are very injurious to the workmen.

"*12th.* That since the recent rise in the price of borax, the medical men in the district have observed a great increase in cases of paralysis and other diseases, usually attendant upon the use of lead (which is substituted for it).

"*14th.* That assuming the freight from Calcutta or Bombay to England, to be £4 per ton, the tincal of India might (in the present state of the market) be brought into competition with the boracic acid from Tuscany, even if the former should cost £70 per ton at the port of shipment, although at such a price there is not likely to be a great increase of demand.

"*15th.* That if, however, tincal could be obtained at Calcutta or Bombay, at about £45 per ton, a ready sale could be found, and a handsome profit realized in this country for a much larger quantity than has hitherto been imported."

The subject had been taken up with much interest by Capt. Hay and others, and it was after communication with them that this address was forwarded.

A very good idea of the locality of production will be gained from the following account, compiled from the correspondence of Messrs. Barnes, Edgeworth, and Hay. In 1854, Capt. Hay wrote as follows:*—

* Letter of Capt. W. C. Hay, Assistant Commissioner of Kangra, to D. F. McLeod, Esq., Commissioner, Trans-Sutlej States. Kangra, 13th March, 1854.

"4. I have visited Pugá, in the territory of H. H. Maharaja Goolab Sing. It is a small valley, which may roughly be calculated at two miles in length, and three-quarter mile in breadth; (*i. e.*, the portion from whence the sohaga or tincal is collected;) it extends east and west, and has a fine stream running through it into the river Indus, but the portion producing the borate of soda, is, if not watered by, still under the influence of thermal springs, varying in four places, where I took the temperature, from 130, 140, 150, to 167 degrees, the temperature of the streams into which these empty, being in July, 56 degrees.

"6. The valley, producing this sohaga, is now farmed, but I cannot ascertain precisely at how much, it being probably an object with the Gatpo, or headman of the Rupchoo population, consisting of about 400 people, to hide from the Tehseeldar of Lé, who collects the revenue, what it really is worth. In 1850, the price paid for the tincal in barter was usually sixteen "háths" of course "lungi" cloth, said there to be valued at one rupee, for which they procured three kucha maunds of the sohága, equal to about one pucka maund of forty seers. I then ascertained, however, that for a company's silver rupee, 10 kucha maunds (equal to 4 pucka or standard maunds of 80 lbs.,) would be given.

"7. Within the last two years it has increased in price, in consequence of the greater demand, and its present price, I am informed by some of the principal carriers and traders, is three sheep loads for one rupee, which is equal to eighteen buttees, or about two maunds and two buttees of kucha weight (about 72 lbs).

"9. Immediately after Kúlú became a British possession, an Armenian merchant (Mr. Arratoon), I remember, informed Mr. Erskine, the then Superintendent of Hill States, that he had sent all the sohaga he could procure to Bombay, where he reaped on sale, a clear profit of 200 per cent.; he remarked, however, that it was in such small quantity, that unless he could obtain several thousand maunds, it would not be worth his while to engage in the trade.

"Remembering this when I reached the spot, I ascertained, as nearly as I could, that the entire produce of the valley might be roughly calculated at 20,000 kucha maunds, (a kucha maund is equal to about 32 lbs.) the greater portion of which found its way to Rampúr in Bishahr; some to Kúlú *viá* Mandi to the lower hills, and a small quantitiy *viá* Chamba to Núrpúr. Nearly all that going *viá* Rampúr is taken into the lower hills in the neighbourhood of Subáthu, Bhaji, &c., where wood is procurable, and where, during winter, it is refined by the carriers who go there to graze their flocks. It thus becomes borax, in which state it nearly all finds its way to Jagádri* in the plains, and thence I presume, goes down the river Jumna or Ganges. It is probable that little, if any, finds its way to England.

"Pugá is not, however, the only place where the sohaga is produced; there is another locality near Rodok, yielding it, from which the route to the plains is *viá* the Nite pass; this borax is said to be of a very superior quality, nearly pure, and requiring little or no cleaning, but it is produced from a portion of Thibet in Changthán, subject to China; doubtless, other localities exist if the jealousy of the factors could be overcome, and enable us to explore. Nearly all the Trans-Himálaya lakes seem to contain salts of various description, well worthy of chemical analysis; to this I shall advert in a future paragraph.

"The transport of this tincal is almost entirely effected on goats and sheep, being the animals at present best adapted to the mountainous path-ways. The trade being to a certain extent precarious, the profits the merchants demand to protect themselves from loss, would at a first view, appear large; when, however, the severity of the climate which they have to encounter, and the losses from snow falling over precipices, &c., are taken into consideration, it is not so exorbitant.

"The price of three sheep loads at Pugá, I have stated to be one rupee; the average journey of a laden sheep being about a kos per diem, it takes nearly one month to reach Kúlú from Pugá, where the same sells for eight rupees, and if cleaned as borax, it sells at Sultánpúr (Kúlú) at five rupees the kucha maund; and if taken to the lower hills at Kudli, Sisova, and Teki, at six rupees the kucha maund. After it is purchased by the Jagádri merchants, I cannot say what expenses attend it, but the difficulties are over, and the prices here quoted clearly show the immense risk that is run on the first month's journey, compared to the second from Sultanpúr to the lower hills, which occupies upwards of a fortnight and sometimes a month, as the sheep get out of condition, and are soon tired after the long journey.

"At present the people depend entirely upon falls of snow, as rain never falls in those regions, and they suppose that snow is necessary to produce the sohaga, which probably might be equally well produced by flooding. The time, I am informed, required for its reproduction is only ten or twelve days; but the sun in July and August is so very powerful, that probably a succession of evaporations might be caused; this would form ground for a chemical report."

* At Jagadri the process of refining is extensively carried on.

The borax does not effloresce on the upper surface of the soil as has been sometimes stated. The upper efflorescence consists principally of a sesqui-carbonate and sulphate of soda, with more or less chloride of sodium. Under this is the borax, which appears as a greasy substance of a greenish yellow color; CAPTAIN HAY remarks that, as there is a deposit of sulphur also found in the same locality, boracic acid might be obtained pure on the spot. The borax occurs in a confused crystalline form, and varies in color, from the greenish yellow above mentioned to dirty white or gray. The natives are remarked by MR. MARCADIEU, to be extremely skilful in digging out the borax, which they divide into three qualities. The third is worthless, and is always left till it turns into the good sort, which it does in a few days. The persons who work the borax, use a piece of wood like a spoon or spatula, with this they scratch away the superficial efflorescence, and dig out the more valuable material below. The qualities of borax, are distinguished by the degree of hardness and weight they possess: one man can collect 80 pounds (one maund) in a day. MR. MARCADIEU* gives the per-centage of pure borax in the crude material as from 76 to 85 per cent. in one set of samples, and from 68 to 80 per cent. in another set; both of the first quality: the chloride of sodium varied from 4 to 5 per cent., and sulphate of soda from a mere trace to 3 and 6 per cent. In the second quality of borax the pure material was from 50 to 72 per cent. Chloride of sodium from 5 to 6, and sulphate of soda and lime, from 10 to 20 per cent. The second quality of borax is in a powdery form. MR. MARCADIEU says, that the first two qualities are usually mixed together, giving the general per centage of borax at 70 to 72 per cent. The third quality is so impure that it is not worth taking away till it has lost its impurities and soluble salts. This purification appears to be effected naturally when a shower of rain falls (which is rather a rare occurrence). The rain water takes up the more readily soluble salts, and sinks into the earth, as soon as the sun comes out the soil dries up, the sulphate and chloride effloresce as a dry white powder, and the borax which is not efflorescent is collected below. There can be no doubt that the elements of these salts exist in the soil, and when rain falls, a catalytic action is set up by aid of the water, resulting in the formation of the sulphates, &c., which effloresce, and the borax which does not. The traders can collect borax from places previously exhausted, or where it was inferior, in about ten or twelve days after the rain (or snow) ceases. The deposit of borax never exceeds two or three inches in thickness, and is succeeded by a lower deposit of inferior material. All traders who come, have a right to collect borax on payment of a fee. The borax is carried away in woollen bags, containing each from twenty-five to thirty pounds; three sacks are supposed equal to a maund, and the Gatpo takes one rupee in coin or in goods for every such triad; scales and weights are not in use.

LORD HAY, Deputy Commissioner of Simla, states, that two kinds of borax are traded in—one, the *tchalleh* of the Thibetans (the sohaga of the plain dialects), which is white and comparatively pure; the other kind, which is in hard earthly lumps, is called *tshoochal* by the Thibetans, and "telíya" in the plains. LORD HAY gives the duty charged at Púgá as eight annas per twenty seers, which is different from MR. MARCADIEU'S statement. The following paragraphs are quoted from LORD HAY'S letter to MR. BARNES, Commissioner of the Cis-Sutlej, in March, 1854.

"The people who engage in the sohaga trade are chiefly Kanáwaris and Khampos (a class of wandering traders) of Lahaul, Thibet and Spiti. In the summer months they resort to the Pugá mines and other places, to which the sohaga found in Tartary is brought, and return in the autumn before the passes are closed to the lower hills, where they remain during the winter pasturing their flocks, refining their sohaga, effecting sales of it to the Simla merchants, and making purchases of miscellaneous goods to take back with them in the ensuing summer.

"The refining process is exceedingly simple and consists of dissolving the crude borax in two parts of hot, or ten parts of cold, water, and then allowing it to crystallize. The tschoochal sohaga is similarly refined, the stones which contain it being first broken up. Formerly it was the custom to cover over the crude borax with ghee to prevent efflorescence;* this practice has been, I believe, discontinued of late years.

"The tschalleh sohaga loses one-fifth, and the tschoochal one-half in weight, in the course of purification. Sohaga is also refined, and generally with much more care, at Jagádri, a large mercantile town between Ambálla and Saharunpúr; the price in Chang Tang is one rupee for sixty-four seers; in Ladákh, it is one rupee for thirty two seers; in the bazars of the lower hills it is usually sold in its impure state at sixteen seers per rupee."†

* The statements of this writer should be received with caution: his paper on Borax, in the Punjab Selections, No XII. is full of absurdities.

* More properly speaking, evaporation or deliquescence in damp weather.

† In the plains the price is often from £55 to £60 per ton. MR. BARNES to MELVILLE, Secretary to the Chief Commissioner, March, 1854.

"To Rampúr and Sultanpúr, about 2,500 maunds, or ninety tons are annually brought. Last year it sold at Simla for nine rupees a maund, or £25 a ton, and at Jagádri it is now selling for twelve rupees, or £37 a ton.

"The trade of borax with Kúlú is almost entirely confined to the merchants of Jagádri. I am informed that they had only a few day's ago, a stock on hand of 2,000 maunds at Jagádri, which they could not find a ready sale for, the sales effected there this season being at Rs. 9-4-0 the pucka maund.*

"The borax is purified in Kúlú before it is forwarded to Jagádri, but there it undergoes another refinement before is is sent on to Furruckabad or Mirzapúr, and eventually to Calcutta, though I have reason to believe, that very little gets so far.

"In consequence of the imports into Kúlú from above being greater than the imports from the plains, carriage to the latter is very scarce, and although a mule brings four maunds of goods to Sultanpúr from Jagádri for Rs. 6-4-0, a mule carrying the same weight from Sultanpúr to Jagádri, receives from ten to twelve, or at the rate of from Rs. 2-8-0 to 3 the pucka maund.

"From Jagádri to Furruckabad it is taken on hackeries, twenty-five maunds on each : for the hire of which, Rs. 50 are paid, and from thence by water ; the price of boat hire varying considerably. These statistics, however, would be a guide to any European merchant wishing to engage in the trade."

"To give an idea of the increase in the borax trade with India, during the last few years, it is only necessary to mention, that while in the years 1846-47, when the price was Rs. 9 a maund only, 1,731 maunds were exported from Calcutta; during the last six months of 1854, the large amount of 10,896 maunds, at Rs. 22 per maund, have been shipped for Europe."†

The following account of the process of purifying sohaga has been received from Jagádri :—

The borax comes from Ladákh, *viâ* Kúlú, Rampúr of Bishahr, and Simla, on the backs of sheep and goats, thence it is brought by ponies and mules to Jagádri and other places, where it is refined. In its crude state it sells at the place of production from Rs. 1-2 to 1-4 per maund, but by the time it reaches the cities of the plains, the cost is Rs. 4 to 4-8 per maund. It is purified by the following process :—

One maund of borax is mixed with double its weight of water, and placed in an iron caldron over a fire, and is there boiled for two or two and a half hours; when the whole is boiled down to a fourth of its bulk, it is removed from the fire, and poured into earthen jars (sabúcha) ; after three days the impurities settle to the bottom, and the borax crystallizes above ; the water is then poured off, and the borax separated from the impurities and dried. About 1,200 maunds are in this way annually purified, and value at about Rs. 10 per pucka maund. One manufactory or shop will purify four maunds per diem. If the crude sohaga be of good quality, four-fifths of the salt is obtained pure ; and if of only moderate quality, half is pure borax and half earth and impurities; while if the raw material be inferior, three-fifths of the whole consists of impurities. The principal market is Fírozpúr, and by thence it is taken to Bombay, and in small quantities to other cities, for local consumption. The principal borax factors are —Tulsi Rám, Hardwarimull, Kánakewal and Kashmírí. It is sold in packets of 10 or 12 seers each.

413.—[285]. Borax. From Ruthog, Pugá and Chángthán. TARA CHAND.

There are two kinds of borax in this sample—one called "chú tsalé," or "water borax," which is the best: it is found at the lakes of Ruthog.

The second requires preparation; it comes from Pugá and Chángthán, and is called "tsalé mentog." Borax flowers, of the first quality, 1 kucha maund, value Rs. 3; of the second Rs. 2¼.

414.—[619]. Borax, from Srínagar.

This salt is also exhibited from Jagádri in Ambálah district [705], from Bishahr in Simla district [703]. While samples are sent from the bazars of Jálandhar, Lahore, Amritsar, and Pattiala, Nos. 733, 742, 852.

The refinement of the crude sohaga is also carried on at Amritsar.

BORATE OF LIME.

415.—[433]. Borate of lime. DR. T. E. B. BROWN, Chemical Examiner.

This salt was first made in India by Dr. O'Shaughnessy, who recommended it as a useful glaze for earthenware.

Having occasion to make a quantity of ammonia for distribution to the districts, there remained a considerable amount of solution of chloride of calcium, as this was not required in itself, it was determined to make borate of lime from it, which was easily done by adding common borax or sohaga.

Borate of lime can also be made by adding borax

* Extract from the letter of CAPTAIN W. E. HAY, Assistant Commissioner in Kúlú, to R. TEMPLE ESQ., Secy. to the Chief Commissioner, Punjab, dated Nugur in Kúlú, 29th November. 1854.

† Letter from MR. EDGEWORTH, to P. S. MELVILLE, ESQ., Secy. Chief Commissioner, Punjab, 3rd February, 1854.

to the nitrate, or any other very soluble salt of lime.

NITRATE OF LIME.

416. -[875]. Nitrate of lime. Dr. T. E. B. Brown, Chemical Examiner.

This is prepared by distilling shora or saltpetre with kahi safed, and neutralizing the acid liquor that passes over with chunam. It is recommended as a manure for lands abounding in salts, mostly sulphates, which need some agent to convert the sulphates which are injurious to crops into nitrates, which are beneficial, or at least harmless.*

This salt has been suggested as a probable remedy for the reh or saline efflorescence, which is so frequent in the Punjab.

The natives, in some parts, have long been accustomed to employ "chikna kullur," or earth which looks damp ; this earth is found where animal remains are deposited, and usually contains nitrate of lime.

The reh is composed principally of sulphate of soda and chloride of sodium, with, in some places, carbonate of soda: the sulphate and carbonate of soda are very efflorescent salts, and melt partly in their water of crystallization at a temperature of about 98°, while they are rather sparingly soluble when the temperature falls below 60°. Hence, during the hot weather the reh melts and percolates the ground to some considerable depth ; but as the weather becomes cooler, crystals form in this soil and form a capillary network, up which the solution travels till it arrives at the surface, where the salt gives off its water of crystallization, and falls into a dry powder by efflorescence. If to a solution of these salts, nitrate of lime is added, no change is produced by it on the chloride of sodium, but the sulphate and carbonate of soda are converted into nitrate of soda, a deliquescing salt, while the lime is changed either into the insoluble carbonate of lime or the sparingly soluble sulphate of lime, neither of which are efflorescent, or in any way injurious to vegetation.

* For an account of "reh" lands, see further on, Division V. Sub-class (C). Soils.

Division IV.—Chemico-Pharmaceutical Substances.

SUB-CLASS (A). MEDICINAL SUBSTANCES, INCLUDING MINERAL WATERS.

Many of the earths, salts, and metallic substances used in both Native and European medicine, are also used in various arts and manufactures, such are the salts, barilla, borax, "kasís," sulphate of copper, and other substances enumerated in the preceding division. It is, however, impossible to exclude them from notice in this class; to eliminate them altogether would be to render the present division a very imperfect representation of a native mineral drug series, while, in point of fact, the actual collection exhibited was almost exhaustive, and left out no drug in use; except perhaps, some compounded mineral medicines, held sacred in the arcana of the hakeems. All such substances will, therefore, receive a passing notice in this division with special reference to their therapeutic qualities, real or supposed; information concerning their manufacture, nature, and peculiarities being found in the class to which they primarily belong. The collection of mineral drugs exhibits what the native practitioners designate as such,—although many of them are now well known to be inert or useless. In not a few instances several substances having different names and forms are considered as distinct medicines, and separately prescribed by native practitioners, although there is no chemical difference in their composition (for instance, the various forms of carbonate of lime); and, consequently, no difference in their therapeutic operation, when the substances happen to have any at all. The report of the jury contains a list of those mineral drugs exhibited, which find places in the British Pharmacopœia, but it does not embrace a fifth part of the actual collection, showing what an immense number are either inert, or else the same substances under changed forms. The tendency of modern therapeutic science is ever to reduce the number of substances in the pharmacopœia, and that notwithstanding the frequent discovery of new agents. The time when many of the native medicines here exhibited found a place in European practice, is within the memory of many persons living; and such experience it is hoped will not be without its effect in enlightening native practitioners as to the real nature of the substances they deal with—teaching them to discontinue the useless ones, which are often not merely useless, but also sources of fruitless expenditure; since we must recollect that they are in many cases imported from distant places, procured with infinite trouble, and sold at high prices, while all the time there is really no healing virtue in them.

SULPHUR.

417.—Gandak or kibrit, "áñwlásár."

Nos. 716, 717, 734, 746, 867, 878, 895, 907, 908, 928, 961-3; have previously received notice in Division II. Sub-class (A.)

Its action is as an alterative and diaphoretic, and a laxative in large doses. It is principally used externally in various forms of skin disease. In native medicine it is often exhibited in the form of "áñwlásár," which is simply *vitrous* sulphur, so called from its resemblance to the translucent fruit of the áñwlá (*emblica officinales*).

Silica.

Silica occurs in native medicines in several forms. In European medicine, it is not used except mechanically to induce the combination of essential oils with water.

418.—[819]. Rock crystal, "bilaur," Lahore bazar. RAM SINGH, Pansári.

419.—[820]. Carnelian, "sang-i-ákík." Do.

420.—[823]. Agate, "sang-i-sulaimán." Do.

This name is given to the onyx also. The stone is not administered in medicine in any form, but is supposed to have the effect when worn, of keeping people at a distance from the wearer, so as to induce solitude (!)

421.—[825]. Flint, "chakmak." Do.

422.—[827]. "Sang-i-asshar."

Supposed to be a form of silica.

423.—[828]. "Sangi assyum," millstone grit. RAM SINGH.

424.—[879]. Sand, "ret."

River sand, not used internally, but applied as a heating agent in cholic, &c., &c.

425.—[821]. "Yashb," plasma or green silica.

The constituents of this mineral are silica, alumina and iron.

Acids.

426.—Sulphuric, nitric, impure nitric, and hydrochloric, "tezáb gandak," "tezáb shora," "tezáb shora wa kahi," "tezáb nimak" (*see* page 61).

These acids are employed in medicine—the sulphuric in small quantities as a tonic; the nitric acid as a caustic, as is also the hydrochloric occasionally.

Sal ammoniac.

427.—Naushádar. Exhibited as a medicine from Lahore, Ludhiana, Jálandhar, and Amritsar (*see* page 89).

This salt is a chloride of ammonium, is valuable in the formation of freezing mixtures, and is used in the manufacture of liquid ammonia. It is rarely employed internally, but is said to be useful in chronic inflammation of the liver and spleen, and in facial neuralgia, especially when of a rheumatic nature.

Carbonate of Potash.

428.—[122]. "Jau khár." Rewárí, Gurgaon. DEPUTY COMMISSIONER.

To make jau khár, growing green barley is cut and burnt, its ashes are mixed with water; if time is an object, the solution is evaporated over a fire, otherwise the mixture is allowed to stand for some days, the sediment settles, and the clean liquid is poured off; the residuum of evaporation is jau khár.

Nitrate of Potash—Saltpetre—Shora.

429.—Nos. 699, 702, 704, 709, 725, 729, 757, 853, 899, 900, 912, 918, 927, 928, 930, 931, &c.

Is exhibited under the forms of a nitrous earth, crude nitre, and crystallized nitre, "shora kalmi." In medicine it is a refrigerant saline, diuretic and antiphlogistic (*see* page 79, *et seq.*)

Carbonate of Soda—Barilla—"Sajji."

430.—Nos. 722, 755, 736, 836, 858, 866, 913, 919, 920, 926, 941.

Exhibited as the black sajji, impure; and the "sajji lota," a superior quality (*see* page 86, *et seq.*). Beside carbonate of soda, sajji contains sulphate of soda and lime, chloride of sodium and potassium, sulpho-cyanide and ferro-cyanide of sodium, silica, organic matter and clay.

431.—[605]. "Phúlí," a salt of soda. Ladâkh. H. H. THE MAHARAJA OF KASHMIR.

This is used to bring out the strength and flavor of tea in infusing it. It contains a little sulphate of soda, much carbonate, and some common salt; its solution acts with ammonia, and precipitates. Value, Rs. 12 per seer.

Alum.

432.—Nos. 636, 934, 935, 954, 955, and 906, exhibited native alums, manufactured in the localities from which they are sent.

The others, Nos. 719, 728, 753, 855, 857, and 956, were bazar alum, exhibited as drugs (*see* page 84).

In medicine alum is an astringent.

Borax—Biborate of Soda—Sohaga.

433.—Nos. 705, 713, 733, 742, 852, and from Pattiála and Simla, without any number (*see* page 90).

It is employed by natives as a tonic for loss of appetite, also as a deobstruent and diuretic in ascitis, also in cases of cholic and ulcerations of the mouth. It is given to young children to promote articulation, and is considered a very valuable medicine. It is employed in European medicine as an alterative in aphtha, as an emmenagogue. Its value as purified borax, is As. 8 a seer. It is used by jewellers to clean gold, also as a flux in soldering, and in making imitation gems.

Sulphate of Soda.

434.—[ ]. Efflorescence of sulphate of soda. Muzaffargarh. Dr. Cookson.

It consists principally of sulphate of soda, and a little chloride of sodium; most of the white efflorescence observed on the beds or paths of gardens and fields, and in "Reh" lands is sulphate of soda.

Chloride of Sodium.—Common Salt.

435.—[851]. Nimak safaid. Ram Singh, Pansári.

436.—[859]. Nimak "gumán" (*see* page 77, No. 369).

437.—[861]. Nimak shísha.

White crystal salt, of which splendid specimens occur in the Shahpúr collection (*see* page 69).

438.—[862]. "Nimak nali."

Salt fused into long pipes, whence its name, "nali."

439.—[863]. Nimak sámbar, from Hissar.

This is an evaporated salt of an extremely pungent taste (*see* page 79).

440.—[877]. Nimak kalri. Lahore, (*see* page 81).

441.—[864]. "Sindá" salt.

A white salt from Sindh (?)

442.—[876]. "Nimak manyárí," is the same as the next, being obtained in the process of glass-making; also exhibited (No. 121) from Bhúnsi of Gurgaon. Deputy Commissioner, Gurgaon.

443.—[877]. "Kachlún," (*i. e.*, the salt of kach or glass).

These last two are the dross or scum of the glass furnace, but they contain a large proportion of common salt mixed with some silica and lime.

Salt acts as a saline refrigerant in small doses; as an emetic and purgative in moderate doses; and as an irritant poison in larger doses.

"Kála nimak," "nimak siya," "kálalún," a dark colored salt, said to be made by dissolving common salt in a solution of "sajji matti" (crude soda), and evaporating it; this salt contains chloride of sodium, sulphate of soda, caustic soda and a little sulphate of sodium, but no carbonate of soda.

444.—[120]. Kálá nimak. Firozpúr. Gurgaon. Deputy Commissioner.

445.—[700]. Black salt, from Bhawání, Hissar. Local Committee.

The black salt is made as follows:—Ingredients, one maund of sámbar or Díndwa salt, ¼ seer; "baherah" (the fruit of *Terminalia belerica*), ¼ seer; "har," (the fruit of *Terminalia chebula*), ¼ seer; aonla (*Emblica officinalis*), ¼ seer; black sajji (impure carbonate of soda): all these are put into an earthen pot over a fire and kept there till scorched; when about 35 out of 41 seers remain, the pot is taken off and the black salt is made. About two maunds of wood are used. The price is now in Bhawání, Rs. 3 per maund. It is used only as medicine, and is exported to the N. W. Provinces and the Punjab. No tax is levied at Bhawání, but it pays duty as salt when taken across the custom's line.

446.—[707]. Black salt, from Jagádri. Ambálla. Local Committee.

447.—[731]. Sample from Jálandhar. Local Exhibition Committee.

Similar sample from Lahore [850].

448.—[760]. Nimak soñchal. Lahore. Ram Singh.

A salt of the same kind as kala nimak.

449.—[893]. Black salt. Gujranwalla.

Which is erroneously described in the original Catalogue as a sulphate of ammonia; and in the vernacular list as "shora ka kism;" the sample is nimak soñchal, or black salt.

450.—[755]. Black salt. Amritsar.

Called in the Catalogue sajji mámúlí, black soda.

Lime—Chuna.

451.— Nos. 723, 902, 1381, and many

others. (*See* page 39, Division II., Sub-class (C). Building Materials, &c.)

Sulphate of Lime.

452.—Represented in the collection under a variety of names—"sang-i-jaráliat," "godanti;" "sang-i-makol" of Lahore druggists, "surma safaid" (897) of Rawalpindi and Jhilam.

The substance has been noticed in Division II., Sub-class (C), as used in Arts and in Building, for Plasters, Gypsums, &c.

Carbonate of Lime.

This is one of those substances which exist under a variety of forms, and illustrate the the statement that a large number of the native mineral drugs do not differ from one another in chemical properties, and therefore not in therapeutic properties.

Carbonate of lime is used in European medicine in a form of chalk, as a desiccant and astringent in opthalmia, gonorrhœa, and other fluxes.

453.—[833]. Sang-i-marmar, white marble. Lahore bazar. Ram Singh, Pansári.

454.—[836]. Bekh-i-marján, fragments of red coral. Ram Singh, Pansári.

Supposed by natives to be a tonic, and taken ground into powder; oftener in a compound form.

455.—[843]. "Surma safaid," calcareous or Iceland spar.

This has been given by natives the name of "white antimony," probably from its rhombohedral fracture, something resembling that of the galena, which is usually mistaken for surma or antimony. Natives use it also for the eyes just as they do sulphide of antimony; it is needless to add, that beyond the name the substances have no affinity whatever. It is found in the rocks at Kabul, and in several parts of the Himálaya. Dose about 7 grains in powder.

The surma safaid, Nos. 929, 902, 897, from the Dera Ghází Khán, Rawalpindi and Jhilam districts, are *sulphate of lime.*

456.—[844]. Karya mitti, chalk. Lahore bazar.

Consists of either of white earth, or whiteing, or imported chalk.

457.—[846]. Sang-yahúdi, "Jew's stone," a fossil encrinite.

458.—[837]. Sang-i-khurús, a fossil encrinite.

459.—[845]. Sang-i-irmali, a fossil.

460.—[959]. Hajr-ul-yahúdi, encrinite. Peshawur. Price Rs. 10 per maund. Local Committee.

461.—[885]. Sang-i-sarmahi, small fossil shells.

Small hard whitish-gray oval shaped shells.

462.—[847]. "Sang-i-shádnaj, fossil nummulite.

463.—[933]. "Sangcha," nummulites, from Mazárí hills. Dera Ghází Khán. Imam Baksh Khan.

They are priced at 32 seers per rupee, and are said to be picked up in these hills by the druggists; it is not improbable that sangcha, meaning "small stone," is not a local name, but only a description given by some native who did not know the name shádnaj.

These fossils have no other virtue than what they derive from being carbonate of lime; but natives on the strength of their doctrine of similitudes, administer them on account of their resemblance to the products of disease.

464.—[881]. Tabákhir. Lahore.

This must not be confounded with *tabáshír*, the silex from bamboos, from which it is quite distinct.

Carbonate of magnesia.

465.—[822]. Pábúd (?)

Is said to be an impure carbonate of magnesia.

(The sample was not found by the jury in the collection, nor is the name known to the ordinary druggists.)

Hydrated Oxide of Magnesium.

466.—[826]. Zahr mohra. Lahore bazar. Ram Singh.

467.—[887]. Zahr mohra khatai. (*i. e.*, Chinese zahr mohra).

This last is considered of great efficacy by natives, who patiently grind it down with water and drink the fluid.

These substances consist of hydrated oxide of magnesium, with a little lime and protoxide of iron.

Silicate of Magnesia.

468.—[631]. Soapstone, sílkhari, from Singhána, Gurgaon. DEPUTY COMMISSIONER.

469.—[960]. Sang-i-jarábat. Peshawur.

470.—[881]. Sílkhari. Lahore bazar. RAM SINGH.

Glass.

471.—[871]. Fused glass, "kach." Lahore bazar. RAM SINGH.

472.—[882]. Fused glass, "phutak." Lahore bazar. RAM SINGH.

Lapis Lazuli.

473.—[824]. Lajward, lapis lazuli.

It is used in native medicine for mixing with jalap powders and in other compounds; it is not taken alone (*see* page 64, *et. seq.*) Dr. Honigberger says he applied it externally to ulcers.

Gil Irmani.

474.—[884]. Gil irmani. Lahore bazar. RAM SINGH.

Armenian earth, "bolus armeniacus," harmzi or harmuchi, has been entered under head of dyes and colors; it is supposed to be the representation of the Armenian bole, once in great repute (*see* page 22).

Earths and Ochres.

475.—Múltáni mitti. This has received notice in Division II. It is used to wash hair, and one kind is taken medicinally by women at child-birth.

476.—Gil-i-geru (No. 762, 721, 849).

477.—Gil-i-makhtum (No. 759 and 840).

478.—Gil-i-zard (No. 718 and 849).

479.—Gil-i-abrúrsí (No. 760).

These earths have received notice in the preceding Division, they are only used in native medicine.

White Clay.

480.—[844]. Kharya mitti. Lahore.

Used only in native medicine and as a plaster. There are several other specimens of white clays and earths exhibited in Division IV. (*see* page 23.)

481.—[848]. "Hassan dhúp." Lahore bazar. RAM SINGH.

This is properly speaking a deposit from a mineral spring containing sulphur; the sediment is collected and made into little cakes, but ordinarily the hassan dhúp met in the bazar is a mere imitation, consisting of some earthy clay mixed with ground sulphur. and formed into cakes.

White Mica.

482.—[898]. Abrak safaid. Rawalpindi. DEPUTY COMMISSIONER.

831 and 898, are samples from Lahore and Jálandhar bazars.

Black Mica.

483.—[832]. Abrak siyah. Lahore bazar. RAM SINGH.

Granite.

484.—[838]. "Sang-i-karand." Lahore bazar.

The sample sent is fine grained granite not corundum.

Slate.

485.—[ ]. Sang-i-Musá, "Moses' stone." Lahore bazar.

Called probably Moses' stone, for its lamellar structure, as if the tables of the Law, given on Sinai, had been on slate tablets.

486.—[829]. Sang-i-sabz, green earth. Lahore bazar.

487.—[ ]. Another sample, from Amritsar bazar.

I have no information as to whence this mineral is imported.

Binoxide of Manganese.

488.—[817]. Nijní or injaní (or inganí). Lahore bazar. LAHORE MUSEUM.

A sample of pyrolusite or oxide of manganese is sent from Kashmír, from the Jammú territory. In the bazar, manganese is obtainable as a black powder, or in lumps of the pyrolusite.

Zinc.

489.—[799]. "Jast," zinc. Lahore bazar.

Oxide of Zinc.

490.—[800]. Oxide of zinc, "missi safaid." Lahore bazar.

This is very impure, contains much carbonate of lime and a little peroxide of iron.

491.—[915]. "Jasd" (Kushta). Gugaira. DEPUTY COMMISSIONER.

Iron.

492.—[724]. Iron filings, "loha chúr." Jálandhar. LOCAL COMMITTEE.

493.—[792]. Ahan (metallic iron). RAM SINGH.

494.—[795]. "Manúhr" (manohar) or loha-ki-mail.

This is dross or slag from the iron furnace.

495.—[797]. "Zafrán-i-hadid." Lahore.

This is mentioned by Dr. Honigberger ("Thirty-five years in the East.") It is a sesqui-chloride of iron, made by burying for 10 days in the ground a composition of iron filings and naushadar, (sal ammoniac,) the damp of the earth causes the sal ammoniac to act on the iron; the process is complete after 10 days, and the substance may be taken up. (Not commonly used by natives).

Sesqui-oxide of Iron.

496.—[796]. Sahanshabed, hematite. Lahore bazar.

497.—[803]. Surma Ispaháni. Lahore bazar.

This is a shining crystalline oxide, called surma, from its resemblance to antimony ore.

498.—[917]. "Kushta lohe ka." Syadwala, Gugaira. DEPUTY COMMISSIONER.

Magnetic Oxide of Iron.

499.—[798]. "Chamak pattar." Lahore bazar.

The hydrated oxide alone is used in European medicine.

Sulphate of Iron.

500.—[726-730]. Kahi safaid, kahi sabz, kahi siyah, hira kasis, noticed in Division III., at page 66. Sent as drug samples from Jálandhar, Lahore, and Peshawur. Sometimes it is called "sajji," erroneously. 790 of Lahore, is kahi sabz.

Bisulphide of Iron.

501.—[794]. Sona makki. Lahore bazar.

Theoretically sona makki should be copper pyrites, and rupa makki iron pyrites; but the two are constantly confused. Iron pyrites is found in crystals at Kálábágh, and wherever coal shales occur throughout the Salt range.

Copper.

502.—[781]. Burád-i-támba, copper filings. Lahore bazar.

503.—[787]. Sang-i-rásak. Lahore bazar.

A mixture of metallic copper with organic matter; it is obtained during the native process of melting copper and brass. A similar sample is No. 752, from Amritsar.

504.—[782]. Sang-i-basri. Lahore bazar.

The dross of copper in tubular pieces; the genuine article is said to come from the city Bassorah (Basrah), where it is collected at the mouths of the chimneys of the copper furnaces.

In native medicine it is administered in some cases of diarrhœa.

Brass.

505.—[788]. "Burád-i-brinji," brass filings. Lahore bazar.

506.—[789]. "Mail missi," dross, obtained in melting brass.

507.—[791]. "Káyá," a compound metal. Lahore bazar.

It consists of zinc, tin and copper, in certain proportions.

Sulphate of Copper.

508.—Níla tutyá.

Both native and European are exhibited in this department, Nos. 747, 4523, 4522, 783, 784, 639 (*see* page 67).

Subacetate of Copper.

509.—[785]. Zangár, "verditer." Lahore bazar.

Is poisonous and acrid.

Arsenite of Copper.

510.—[811]. "Haryáwal," arsenite of copper. Lahore bazar.

This is known as Scheele green, or the artists' emerald green, and is imported from Europe.

Oxide of Copper.

511.—[916]. Oxide of copper (kushta tambe ka). Gugaira. DEPUTY COMMISSIONER.

A sample is also exhibited from Sirmúr. No. 712, which is a black oxide of copper.

Chromate of Lead.

512.—[878]. "Peori wilayiti." Lahore.

Imported from Europe. It is made by treating a solution of acetate of lead with bichromate and chromate of potash. Yellows of all shades are produced by varying the strength of the solution, or by employing chromate instead of bichromate, from the palest "primrose yellow" to deep "orange chrome."

Bichromate of Potash.

513.—[4355]. Kahi surkh (kahi lál). Amritsar bazar. LOCAL COMMITTEE.

Is imported from England.

Sulphide of Antimony.

514.—Surma, Nos. 761, 802, 880, 901, 902, 904, &c., &c. (*see* page 10).

Used by natives for the eyes, it is supposed to strengthen the nerves of the eye. Found in various parts of the hills; and often confounded with galena.

Surma Kandahárí, is commonly galena.

Surma Ispahání is a glistering oxide of iron ore,

Tartrate of Antimony.

515.—[804]. Nimak-i-istifrág, tartar emetic.

Not met with in the bazar: is mentioned by Dr. Honigberger as existing, and with the name quoted above; but no specimen could be procured.

Arsenious Acid.

516.—[805]. Sankhyá safaid (sammul-fár, *Arabic*), white arsenic. Lahore bazar. RAM SINGH, Pansári.

517.—[807]. Another kind, of a more crystalline texture.

518.—[806]. "Sankhyá bilauri."

Vitreous arsenic, soon becomes opaque by contact of air.

Arsenious acid is a powerful alterative and febrifuge, ranking next to quinine; is said to be best in cases of tertian fever; it may be given in doses of $\frac{1}{8}$th of a grain twice a day, during intermissions of fever, and gradually increased up to $1\frac{1}{2}$ grains; it must be stopped if any pain or diarrhœa occur.

Orpiment—Sulphuret of Arsenic.

Used as an alterative in syphilis and certain skin diseases. There are several varieties. Tanki hartál, or hartál warki, hartál píli (or sankhyá píli), &c.

This mineral is found native on the hills in several parts of India.

519.—[808]. Sankhyá píli, yellow arsenic. Lahore bazar.

520.—[813]. Hartál píli.

521.—[815]. Tanki hartál, or "hartál warki," shining or leafy orpiment. LAHORE MUSEUM.

This is a very beautiful specimen of the mineral in shining lamellar mass.

522.—Hartal is exhibited also from Swat, by the PESHAWUR COMMITTEE; and from Amritsar (751). *See* page 66.

Realgar—Bisulphide of Arsenic.

523.—[750]. "Mansil." Amritsar. LOCAL COMMITTEE; also (814) from Lahore.

524.—[809]. Sankhyá surkh. Lahore. RAM SINGH, Pansári.

525.—[810]. Sankhyá siyah, black arsenic. Lahore. MR. B. POWELL.

Very impure, hence its dark color.

526.—[816]. "Naushádar káni."

An artificial bisulphuret of arsenic, occurs in glossy brown lustrous fragments, like pieces of shellac.

Lead.

527.—[777]. "Sísha," "surb," from Lahore bazar. RAM SINGH.

Sulphuret of Lead.

528.—[803]. Surma kandahári. Lahore bazar.

Called antimony, but is really a sulphuret of lead, or galena (*see* page 10). It is brought from Kandahár.

Oxide of Lead—Massicot.

529.—[706]. Murdá sang. Jagádri, Ambálla. LOCAL COMMITTEE.

(754) and (778) are specimens from Lahore.

The manufacture was introduced at Jagádri by Kashmíri and Bakál, two attah sellers, &c., who came from Jalálábád; they manufactured it in secret, and would not let others know the process. They then charged fancy prices for the produce of this monopoly; since then, however, another native of the city, Ali Ahmad, has obtained the secret from a relative of Kashmíri's, and at present about four people, two besides Kashmirí and Ali Ahmad, understand the process.

The apparatus consists of two small mud furnaces, and two earthen vessels the lower parts of which are luted with clay to strengthen them and protect them when placed over the fire; these vessels are small mouthed, and spherical at the bottom, and are called "tolas." They place a quantity of metallic lead in one of them, and heat it over one of the furnaces till it is melted. Supposing the quantity of lead in the earthen jar to be one maund weight, the manufacturer takes in proportion to this quantity, one-quarter of a seer of fine saltpetre; he sits near the furnace and continually stirs the melted lead with an iron spoon, when the lead becomes red hot, he begins to throw in a little saltpetre, and so continues throwing in little by little till the one-quarter of a seer is finished. At this stage the mass becomes a porous pumice-like mass, and it is then taken off the fire; when cold it is transferred to the second earthen vessel, which is ready to receive it, and this is placed on the second furnace. This second furnace is constructed like a hollow dome closed above and open only at both sides, from one side it is lighted and the other side is closed by a valve, consisting of a flat piece of clay with a small hole in it to allow the egress of smoke. The earthen jar with its contents is now placed inside the beehive-like furnace, supported on two bars of iron fixed within. The workman is furnished with a long iron rod which he inserts into the furnace by one of the lateral orifices, and so reaches the vessel and the lead within, which latter he constantly keeps stirring up: during the process the metallic lead and impurities separate, and when the jar is taken out, murdá sang is found on the surface, and a residue of metallic lead beneath it. The lead that remains, may be again melted, and mixed with saltpetre as before, till all the metallic lead is completely oxidized. About one-half the quantity of lead is converted into massicot at one process.

The cost of manufacture is Rs. 14 per maund, and the selling price Rs. 15 per maund; the manufacturers do not work continuously, but only when there is a demand. About 100 maunds are made in a year, but the quantity varies.

Red Oxide of Lead.

530.—[779]. Sandhúr, red lead. Lahore bazar. RAM SINGH, Pansári.

A similar sample is exhibited from Amritsar. It is usually made at Lahore by exposing melting lead to a stream of air: the process requires careful regulation.

Carbonate of Lead.

531.—[779]. White lead, ceruse, "safaida." Lahore bazar.

532.—[914]. "Kushta sísa." Gugaira.

Used in making other preparations of lead for medicinal use: it is imported.

Tin.

533.—[799]. Metallic tin. Lahore bazar.

Mercury.

534.—[764]. Símáb, (lit. "silver water") or párá. Amritsar bazar. LOCAL COMMITTEE.

535.—[772]. Párá, from Lahore.

Sold in small hollow pottery ware balls, with a minute hole stopped with wax.

Calomel.

536.—[749]. Raskapúr. Amritsar. LOCAL COMMITTEE.

537.—[776]. Raskapúr. Lahore.

A ponderous crystalline mass. Contains calomel

mixed with corrosive sublimate. It is made at Lahore and Amritsar by subliming sulphate of mercury with common salt: it is used in medicine as a powerful alterative.

Bichloride of Mercury.

538.—[748]. Dar chigná, corrosive sublimate. Amritsar.

539.—[775]. Dar chigná. Lahore.

This is also a powerful alterative and corrosive poison. It is made at Lahore.

Sulphide of Mercury.

540.—[752 and 1395]. Shingarf, cinnabar. Amritsar.

Sold in red specular crystalline masses, which are native cinnabar. The brightest native cinnabar comes from the Philippine islands.

541.—[774]. A sample from Lahore.

It is used in medicine; sometimes as a fumigatory. It occurs native as an ore, or is made by combining mercury with saltpetre, and subliming the product.

Silver.

542.—[770]. "Wark chandi," silver leaf. Lahore. Ram Singh.

Used in native medicine.

543.—[771]. "Chandi ki mail," dross produced in silver melting. Ram Singh.

Nitrate of Silver.

544.—[842]. Sang-i-jehannim, or "kástak" (corruption of "caustic,") lunar caustic.

Made at Lahore by dissolving metallic silver in nitric acid.

Gold.

545.—[768]. "Sona ka wark," gold leaf, Lahore bazar.

546.—[769]. Dross of gold melting pot, "sona ka mail."

A dark colored slag in small fragments, consisting of lead, iron and tin, partly oxidised. Gold leaf is now discarded from European medicine: it is used as a test.

Lignite.

547.—[703]. Sang-i-salájit. Taharpúr, Ambálla. Local Committee.

[701]. Salájit, from Tosham, Hissar.

548.—[868]. Salájit, from Lahore.

This substance has no place in European practice.

Momyai.

549.—[841]. Momyai. Lahore.

This is in reality a dry mass of tar. Real momyai is said to be rarely met with; it is supposed to be of great efficacy in healing bones, it is in fact a "osteocolla." It is said to come from Persia, where it exudes and floats on the surface of a certain spring, whence it is collected and monopolized by the government, who sell it at a high price. A story is told, that it was discovered by a certain prince, who when out hunting wounded an antelope and broke its leg; the animal limped away towards a spring near, and was presently observed to be much restored: the attendants went to the spring, and discovered the momyai, which was afterwards tried, and determined to be invaluable for healing broken bones! Pieces of coal or salájit are sometimes sold as momyai.

550.—[2943]. Zifti rúmi is also tar.

551.—[604]. Momyai. Ladákh. H. H. The Maharaja of Kashmir.

Appears to be a hardened petroleum.

552.—[870]. Kahruba, amber. Lahore bazar.

It is brought from Bombay. In reality is a fossil gum resin, but natives have a superstition, that it exudes by the influence of the sun on particular days from the stem of the plantain, which on ordinary days they state gives out the sundras (gum resin of *Vateria Indica*), and which they class along with amber. Amber is represented in medicine by succinic acid, succinate of ammonia, &c.

Compound Mineral Drugs.

553.—[712]. Five (so called) metallic salts, or kushtas, from Simla States.

(1.) Kushta múnga. A pink powder, which is intended to be powdered coral, which is used by natives as a drug; but the sample is *not* pounded coral.

(2.) Kushta abrak. Black talc pounded fine.

(3.) Kushta hartál. A gray powder, contains no trace of arsenic; contains carbonate of lime.

(4.) Kushta mis, or támbá. Is a black oxide of

copper, prepared by mixing some salt of copper with sajji ; or impure carbonate of soda.

(5.) Kushta kalai, a preparation of tin or zinc.

554.—[914-17]. Series of compound mineral medicines called kushtás, consisting of—kushta sikka, kushta jast, kushta támbá or mis, and kushta loha. From Syadwalla, in Gugaira.

These are preparations made as medicines by natives hakims, they are not unfrequently compound bodies (murakkab), though called by the name of a simple constituent, taking their name from the metal which forms their basis.

The following is an account of these preparations sent from Gugaira, which was kindly communicated to me by Mr. R. G. Melville, Offg. Deputy Commissioner.

Kushta sikka, or carbonate of lead.—1 tolah of lead is placed in an iron pan, with the juice of the *Euphorbia*, or the "kesu," or "dhak" flower (*Butea frondosa*). The lead is covered up with the flowers in the iron pan, which is then placed over a fire, where it remains till the lead is melted and the flowers are incinerated. After it is cool it forms the oxide, which is then ground fine and kept for medicinal purposes; it is efficacious in menorrhagia, &c. Given in doses of one "ratti" (the weight of one seed of *Abrus precitorious*).

Kushta jast, or oxide of zinc.—2 tolahs of zinc are placed in a small iron crucible having a handle (called karchi), this is placed in a furnace which is urged with bellows, as soon as it is melted it is to be constantly stirred with an iron rod, when it oxides by contact with the air. It is used as a medicine for diseases of the eye (opthalmia).

Kushta támbá, or arsenite of copper.—1 tolah of copper is taken and beaten out into a thin sheet, after which it is cut up into small slips, to which 1 tolah of "hartál" or orpiment is added, both are tied up together in a piece of cloth and the little parcel is covered with 4 seers of cow dung, it is then set fire to ; when burnt, there remains a bluish crisp substance, which is then ground in a mortar and kept for use. It is used as a medicine for paralysis, contraction of the limbs, and arthritis.

Kushta loha, called khubs ul hadid, or zafrán ul hadid.—1 tolah of iron is made red hot and cooled in cows' urine 100 times, and washed with spring water fifty times, it is then broken and ground in a mortar, after which it is mixed with the milk of "múdar," or "akh" (*Calotropis procera*), and made into a cake; it is then placed in a small crucible called "kotháli," and put between 4 seers of dried cow dung and set fire to ; it is then taken out and mixed with the juice of a plant, "ghikwar" or "koár gandal" (*aloe perfoliata*) five times, and afterwards mixed five times with the extract of a shrub called "kandyári" (*solanum Jacquini*,) burning it between each time of mixing; after which it is again mixed five times in the same way with a grass called "háthi súndíbútí," it is then soaked in "dhai" (curdled milk), and the infusion of "bahera" (fruit of *Terminalia belerica*), har (*T. chebula*) and aonlá (*Emblica officinalis*), it is then soaked again in "koar gandal" juice three times, and eventually ground in vinegar. When dry it is then used as a medicine in liver complaints ; also for *hemorhoids* and stricture of the urethra (*silsil-ul-baul*). In doses of from two to four rattis.

Mineral Waters and Deposits therefrom.

The mineral springs of the Punjab are always situated either in the hills or in submontane districts ; there are hot springs, saline and sulphurous waters. Petrifying streams, in limestone districts, are not uncommon.

The following series of mineral waters was exhibited by the Local Committee of Kangra District.

555.—[270]. Water, from Bishasht, Kangra. Kúlú.

556.—[271]. Water, from Manikarn.

The temperature of Bishasht spring is 102° Fahr. That of the principal spring at Manikarn 202° Fahr. Mr. Marcadieu states that neither of these springs contains sufficient mineral matter to warrant its being termed a mineral spring ; and that if there be any foundation for the high estimation in which these waters are held by the people, it must be merely in the salutary effects of hot baths.

This conclusion, however, has not been generally received, and a fresh analysis of the water seems desirable.

557.—[272]. Water, from the Jawálájí spring.

The Jawálá Mukhí range is a portion of the outer parallel of the Sub-Himálayas. It is composed of a sandstone of the later tertiary period. The springs are situated all within a distance of about 30 miles, near the base of the hills, on their south westerly face, looking towards the Beas ; all contain chloride of sodium (common salt) and iodine, stated by Mr.

MARCADIEU, to be in the form of iodide of potassium in considerable quantity.

In proceeding by order of their respective positions, and taking for starting point the limits of the Jawálá Mukhí valley, naturally formed by an elbow of the Beas near Nadaun, the salt iodurettcd springs are placed in the following order; 1st, Kooperah; 2nd, Jawálá; (two springs); 3rd, Jowálá Mukhí; 4th Nageah, and 5th, Kanga Bassá.

The three first are situated at equal distances of about four miles one from the other, the fourth at about three miles from the third, and the fifth at about twenty miles from the fourth.

In general, the greatest uniformity exists in this range of hills.

The argillaceous marls alternate towards the superior part, with a rough and friable micaceous sandstone; and at the inferior part, with a sandstone also micaceous, harder, smaller grained, and of a bluish color, held together by a calcareous cement.

After this comes the same sandstone, in which are embedded a few stones of variegated grit and micaceous sandstone, and next to it a scanty calcareous formation in the state of travertin; at last, on nearing Kangra, and leaving the springs, there are some conglomerates, composed of granite, of mica schists, of quartz, and of variegated sandstone, also bound together by a calcareous cement, alternating at first with the grit, and afterwards forming whole beds by themselves.

The natives of the place affirmed that the saline matter in the springs became more abundant during the rains, and that it yielded them a large quantity of salt.

The saline springs contain, in 100 parts, the following quantities of fixed matter:—

Kooperah, ...	2·20
Jawálá, ...	2·63
2nd spring, Jawálá, ...	2·40
Jawálá Mukhí, ...	2·28
Nageah, ...	2·22
Kanga Bassá, ...	2·32

The temperature of the first spring taken on the 10th December, 1854, at 7 o'clock A. M., was 67° Fahr., the air 51·30, difference 15·70.

This spring issues from a hole made by the natives in the hard grit, it does not appear very abundant, because its issue is evidently impeded by the surrounding rocks which prevents one from ascertaining the real volume of its water in a given time.

All the water from the five springs after having undergone slight concentration by being exposed only for a few hours to the open air, is purchased by the bunniahs at one anna per seer, or exchanged for the same value in attah, &c.

The livelihood of the natives living in the vicinity of these springs is chiefly earned by this trade.

They are convinced, and tell all who question them, that the water contains an efficacious principle which promotes the cure of the goitre.

The following Table shows the produce yielded by the saline iodurctted springs.

Name of spring.	Parts of water.	Salt.	Iodine.	Equivalent in ioduret of potassium.
Kooperah, ..	1·000 45·454	22 1·000	0·0799 3·6318	0·1052 4·7818
Jawálá, ..	1·000 38·000	26·30 1·000	0·09324 3·5452	0·12273 4·6665
Jawálá, 2nd spring, ...	1·000 41·666	24 1·000	0·0799 3·4958	0·1052 4·3838
Jawálá Mukhí, ..	1·000 43·860	22·80 1·000	0·0799 3·5040	0·1052 4·6140
Nageah, ..	1·000 45·045	22·20 1·000	0·9324 4·200	0·12273 5·5282
Kanga Bassá,	1·000 43·478	23·0 1·000	0·09324 4·0539	0·12273 5·3360

In Europe, a medical committee, solicited by different governments, proposed to mix $\frac{1}{1000}$ of ioduret of potassium with the salt destined for the daily use of the mountaineers afflicted with the disease, or living in places where the infirmity exists.

Here nature offers this remedy ready formed, and in larger proportions without the excess being injurious; besides there is a chance of finding a sufficient quantity of salt to render it profitable in a commercial point of view.

558.—[273]. Ainlé (?) spring.

559.—[274]. Bassá spring.

560.—[275]. Mineral water, from Bohan.

Traces of an excavation are shown, which is stated to have been made in the time of Sansár Chand, the Katoch sovereign of Kangra, in the hope of reaching the deposit of salt in which the springs were supposed to take their rise. It has, indeed, been stated that the percentage of saline matter varies slightly in the different springs, and also that the amount of saline matter thrown up increases in the rainy season. These facts, if they are correct, tend to show that the source of the salt is not far from the surface; still it is the opinion of CAPT. HAY, and is indeed the conclusion that is the most coinci-

dent with geological considerations, that the source of the springs is not in any workable deposit of salt such as are found in Mandí. It may be added that, while the Jawálá Mukhí waters contain a large percentage of iodine; Dr. Fleming states as the result of his analysis that not a trace of it can be found in the rock salt of Mandi.

561.—[276]. Mineral water, from Kohalla.

The people of the neighbourhood use the salt obtained from the evaporation of the water as alimentary salt, and the springs are largely resorted to by persons afflicted with goitre, for which iodine is a well known remedy.

562.—[277]. From Jívali spring, Bara Bungálí.

Elevation 4,500 feet. Mr. Marcadieu, geological surveyor, reports that this water contains bromium, probably as bromide of sodium. The following are the results obtained from 40,000 parts of saline water.

Bromide of sodium, ... 0·48
Or from 1000 parts of saline water,
Bromide of sodium, ... 0·012

563.—[714]. Water from hot springs at Jeura. Mr. Geo. Jephson.

Simla.

564.—[715]. Saline deposit from do.

565.—[716]. Sulphur deposit.

566.—[872]. Saline deposit from a spring on the road, a few miles from Dalhousie. Mr. B. Powell.*

567.—[873]. Water from the sulphuretted hydrogen spring at Danera.

This spring is considered sacred by the natives, who resort to it for cure in goitre and other diseases; it is situated about a quarter of a mile off the main road to Danera. The narrow pathway which leads to it has been years ago rudely paved with stones; the spring itself is confined by an artificial tank of stones, in which the water rises up with bubbles of the strong smelling sulphuretted hydrogen, and trickles over the edge of the tank into a shallow stream, whose course is marked by the abundant white fur-like precipitate, which covers the stones, leaves, &c., over which the water passes, and hangs in threads over the tank edge, where the water escapes. The water is not very clear, and its taste somewhat saline. The spring is not a thermal one, but its exact temperature was not observed. A small wayside spring in the hills, near Dalhousie, was observed to have a strong chalybeate taste, and deposited the reddish precipitate indicative of iron. No. 874 showed a leaf and a stone covered with the white deposit alluded to.

568.—[964]. Bottle of bitter water, from a well in the Farídkót fort. H. H. The Raja of Faridkot.

* The saline deposits examined consisted chiefly of carbonate of lime and sesqui-oxide of iron, deposited owing to the escape of the carbonic acid.

The water, No. 872, from Danera, was examined: no trace of sulphate of hydrogen remained at the time it was analysed, but a considerable amount of carbonate of soda, with some carbonate and sulphate of lime.

The sample was not sufficient in quantity to determine the proportions of these ingredients.—Dr. B. Brown, Chemical Examiner, for the Punjab.

SUB-CLASS (B) RARER SUBSTANCES USED BY THE SCIENTIFIC CHEMIST.

There is scarcely any substance exhibited to represent this Sub-class. Borax may be mentioned as used for a flux in experiments with the blow pipe, and there is one other,—

569.—[866]. "Lotá khár." Lahore bazar. Ram Singh, Pansári.

A very impure cyanide of potassium. The salt is so impure that it does not contain more than about 2 per cent. of the cyanide. It is made by fusing yellow prussiate of potash with carbonate of potash : it is used to form a solution with nitrate of silver for electro-plating.

This concludes the collection under Divisions III. and IV. The report of the jury follows. The Divisions III. and IV. are very similar as to the nature of the substances they include, and most of the substances in the former, whose prominent use is in some art or manufacture, have also medicinal virtue in the Native Pharmacopœia ; hence the two Divisions are appropriately classed together for consideration by the same jury. The distinction between Divisions II. and III. has been based on the employment of the term Chemical Substances to signify substances that are compound in structure, such as metallic salts, oxides, &c., and not simple minerals as sulphur, asphaltum, or plumbago.

REPORT ON MINERAL DRUGS.

SECTION A. CLASS II.

DIVISIONS III. AND IV.

DIVISION III. CONTAINING CHEMICAL SUBSTANCES USED IN MANUFACTURES; AND DIVISION IV., CHEMICAL SUBSTANCES USED IN MEDICINES.

JURY.

W. GREEN, ESQ., M. D., *Deputy Inspector General of Hospitals.*
H. ELTON, ESQ., M.D., *Medical Store-keeper.*
J. B. SCRIVEN, ESQ., M.D., *Principal, Medical College, Lahore.*
A. M. DALLAS, ESQ., *Inspector General of Prisons.*
J. PENNY, ESQ., M.D., *Civil Surgeon, Lahore.*
B. POWELL, ESQ., C.S., *Curator of the Museum.*
J. BARTHELEMY, ESQ., *Apothecary to the Citadel.*

The jury called as Assistants for the Vernacular—

RAM SINGH, *Drug Merchant.*
BASHI, *Manufacturer of Acids and Chemicals.*

REPORTER—DR. BURTON BROWN, *Chemical Examiner.*

These divisions are invested with considerable interest, both by the fact of their including many substances, such as nitre, borax, antimony and sulphur, which are of great economic value; and also by their indicating to what extent substitutes for European medicines can be obtained from the bazars: at the same time they show the various substances which the native practitioners of this country are in the habit of using in lieu of the purer, and therefore more efficacious remedies of English medicine.

In the mineral division of the Pharmaceutical Section there were 247 specimens.

The Lahore collection alone contained as many mineral drugs as were obtained from all the other districts united.

The following substances deserve especial notice.

SULPHUR.

Several specimens of different kinds of this remedy were sent: in particular a fine colored specimen, No. 878, from Lahore; and a piece of sulphur in its matrix, No. 907, from Shahpúr: a considerable amount is be found in the Salt range. This substance is very valuable both as a medicine and in chemical manufactures.

WATER.

The mineral waters exhibited were principally those of the hills of the Kangra district; containing saline matter, and in some cases iodine; some white deposits on leaves and stones, Nos. 872 and 874, were sent from Dalhousie, and included in the Lahore collection. These proved to be carbonate of lime and sesqui-oxide of iron, which were probably precipitated, as the carbonic acid which held them dissolved in the water escaped into the air. Only one of the specimens remained for examination, No. 873. This proved to be an alkaline saline water, but it contained when examined, no sulphuretted hydrogen.

SILICA.

Several minerals composed of this body are still included in the Native Materia Medica, though it has long been known in European practice to be inert. The principal ones, were carnelian, (No. 820,) from Lahore: (native name, 'akík:) agate, (No. 823,) also from Lahore, called sang-i-Salaimání; flint (No. 821,) "chakmak," and sand, (No. 877,) "ret." The carnelian was employed on account of its red color, resembling that of the blood; it being formerly thought that medicines had indications in their physical properties and appearances of the purpose for which they should be used.

SAL AMMONIAC—NAUSHADAR.

Numerous specimens of this important salt were sent: a good clean salt from Lahore, (No. 854,); another from Gujranwalla (No. 894). This salt is said to be obtained by burning bricks made of clay, which is full of organic matter, from the bottom of certain ponds; and is believed to be formed by the decomposition of the aqueous vapour by contact with red hot bricks in the presence of air. The crude salt so obtained is refined by sublimation. An interesting specimen of the vessel in which this operation is performed is shown, No. 18, Kurnal. It consists of a thin glass vessel, with a nearly globular body, and a long wide conical neck, and is coated externally with clay to prevent its fusion by the heat which is applied. Sal ammoniac is not only valuable as a medicine by itself, and might probably be used more than it is with good results in our dispensaries; besides this, it is important as a source of most of the compounds of ammonia, and is used at Lahore for the manufacture of solution of ammonia, for snake bites, to a considerable extent.

CARBONATE OF SODA—SAJJI MITTI.

An impure alkali, similar to the barilla, prepared in Spain and elsewhere, by burning plants containing soda salts. Sajji mitti is made by burning plants called by the natives "khár," and which appear to be various herbs belonging to the natural order Chenopodiacæ, particularly the *Anabasis multiflora* and the *Coronylon Griffithii*. The ashes which fuse and run into a gurrah placed beneath the burning heap, are termed sajji lotah, and are considered purer. Sajji consists of about half its weight of carbonate of soda, mixed with clay, sand, and organic matter; also the sulphates of soda and lime, the chlorides of sodium and potassium, and the sulphide and sulpho-cyanide of sodium; the last salt may easily be extracted by boiling the mass with alcohol.

Sajji mitti would be a very available source of carbonate of soda for our dispensaries, but would not be worth exporting, as the pure salt is made so cheaply in England from common salt.

COMMON SALT—NIMAK.

Is exhibited both as salt, the produce of the mines, and as a medicine. In the former department there is rock salt of a dark color, sent by the Rajah of Mandi, from the Drang and Gumatí mines; and from the Kangra district is sent some salt (impure) that comes from Ladákh, and is used in the higher parts of our hill country. From the great salt district, the country about Pind Dádan Khán, Shahpúr and Kálábágh, there is very fine set of specimens, some of which require especial notice. From Kathá, in the Shabpúr district, are sent fine cubical crystals of salt, perfectly colorless, as clear as glass; from the same mines are several other specimens of pure salt; from the Kheura mines, in the same district, are many pieces of pure massive crystallized salt, some slightly colored red, the coloring being due it is said to organic matter.

The salts exhibited in the Medicinal Department, consisted of very fine crystals. No. 863, from Lahore, was called "nimak shísa;" the crystals were, however, inferior to those in the Salt range collection; there were also several less pure specimens, as "nimak sámbhar," (863,) "nimak sonchal," (860,) &c. Under this head also must be included "nimak siyah," or black salt, said to be made by evaporating a mixed solution of sajji and salt, but the specimens sent contained no carbonate of soda, but were composed of chloride of sodium with sulphide and sulphate of that metal.

BORAX—SOHAGA.

This important salt was well represented by several good specimens from Amritsar, (No. 743,) and Lahore, (No. 852.) It is procured in considerable quantity in the Trans-Himálayan regions, from deposits on the edges of lakes, and is imported into England. Its use in medicine, though considerable, is limited; but it is of more service in the arts, both in forming glazes for pottery and to dissolve oxides of metals, thus facilitating their junction.

REH SALT.

A specimen without number, sent by Dr. Cookson from Muzaffargarh; it consists principally of sulphate of soda with a little chloride of sodium; it is in fine prismatic crystals very efflorescent, and might be used with economy in dispensaries as an efficient substitute for Epsom salts—sulphate of magnesia.

NITRE—SHORA.

Several beautiful specimens of this salt were shown, especially one called "kalmi shora," from the pen-like length of its crystals, from Lahore (No. 853.)

This valuable salt is extensively manufactured in many districts of the Punjab, being obtained from soils where animal decomposition is going on. Specimens were sent from a very large number of districts—Hissar, Rohtak, Ambálla, Ludhiana, Jálandhar. Amritsar, Lahore, Gujrát, Shahpúr, Gugaira, Dera Ismaíl Khán, Dera Ghází Khán.

CARBONATE OF POTASH—JAU KHAR.

An impure carbonate of potash is manufactured from the stalks of the barley plant, by burning them and collecting the ashes; this, however, contains much of the chloride and sulphate of potassium and of carbonate of lime. A much purer salt is sometimes prepared by natives by heating wood charcoal with nitre, but no specimen of this is shown.

CYANIDE OF POTASSIUM—LOTA KHAR.

This salt is made at Lahore for the purpose of electro-plating, from the yellow prussiate of potash and carbonate of potash, but the product is very impure.

GYPSUM—SULPHATE OF LIME.

Of this a great number of specimens were given under very various names; thus No. 830, Lahore, is called sang-i-jaráhat; No. 834, is called godanti; No, 902, from Jhilam, is called "surma safaid," as also No. 897, from Rawalpindi. This latter name was probably given by mistake, as it is usually applied to the carbonate of lime; "makol," (No. 798,) is another specimen from Lahore. Sulphate of lime is more used in the arts that in medicine, it is particularly useful in the form of plaster of Paris, for casts, making stucco, &c.

NITRATE OF LIME.

No. 875, (Lahore,) was sent recommended as a probable chemical antidote for the salts of "reh." It has long been known among natives that the best remedy for reh is the saline efflorescence of old mortar in walls, or which appears on ground containing carbonate of lime and animal matter. In this substance nitrate of lime is found; and this salt would act by producing the insoluble carbonate of lime, and the sparingly soluble sulphate of lime, and the deliquescent nitrate of soda, instead of the efflorescent sulphate and carbonate of soda, which are the principal constituents of reh.

CARBONATE OF LIME.

Very many specimens of this were exhibited. Marble, (sang-i-marmar, No. 833,) opaque calcareous or Iceland spar, (surma safaid, No. 843,) and chalk, "kharya mitti." Others were primarily derived from the animal kingdom, as coral, No. 836, (from Lahore); fossil encrinites, sang-i-yahúda (No. 846 and No. 870, Lahore); also a minute fossil bivalve shell (Lahore); and nummulites, "sangcha," (No. 933,) from Dera Ghází Khán; and sang-i-shádnaj" (No. 847, Lahore); these are interesting as showing that the natives employ fossils as medicinal substances, which are less fit for use than ordinary chalk.

ALUM—FHITKARI.

Numerous specimens of this useful drug were sent. A very good crystallized specimen, No. 906, from Shahpúr, and two from Lahore, showing both the red and white varieties. This salt is manufactured in large quantities in the Punjab, from alum shale, of which a specimen, No. 905, was sent from Shahpúr, and also No. 936, from Dera Ghází Khán. The salt as found in the bazar is quite pure enough for medicinal use.

OCHRES.

Several specimens of ferruginous earths were exhibited under the names of geru, gil irmaní, Múltáni mitti, gil zard, &c., but these are no real service in medicine. The same remark applies to the specimens of glass, mica, and steatite; also granite, which will be further referred to in the Catalogue.

It may, however, be desirable to distinguish the various kinds of ferruginous clays used. No. 762, geru or gerí, is a hard laminated red earth, used as a dye for cloth.

GIL IRMANI.

The representative of the Armenian bole, a rough red but irregular mass, resembling "geru" in color, not used in European medicine, but formerly employed, and is still used by natives.

GIL-I-ABRORSHI.

A rough hard, not brittle, pink earth, only used in native medicine.

GIL ZARD.

A pale yellow tough laminated earth, intermediate in color between geru and gil Múltání; but resembling both in appearance.

GIL MULTANI—FULLER'S EARTH.

A soft laminated white or pale yellow earth, used by the natives for cleaning their hair, and in medicine.

GIL MAKHTUM.

A soft rough irregular variegated marl, containing clay, deeply colored by peroxide of iron, mixed with nearly white carbonate of lime.

GIL KIRIA.

A soft laminated, nearly white clay, resembling chalk in appearance, hence probably the name.

HASSAN DHUP.

A harder white clay. The real article is supposed to be a deposit (containing sulphur) from a mineral spring.

BINOXIDE OF MANGANESE—JUGNI OR INJNI.

A single specimen of this important mineral, so useful in making chlorine and oxygen, was shown from Lahore, No. 817; it is principally used at Lahore to remove the color of glass containing iron, and is said to be imported from Kashmír and Kábul.

OXIDE OF ZINC—MISSI SAFED.

An impure specimen of this drug, No. 800, was also exhibited by the Lahore Committee.

OXIDES OF IRON.

Several specimens of these were exhibited; one in particular, No. 803, was worthy of notice, as it was called "surma Ispahání." Several substances are often substituted in the bazars for sulphuret of antimony, and this was one.

SULPHATE OF IRON—KAHI.

This substance is said to be produced by concentrating the mother liquid, from which alumina has crystallized out, and it therefore contains much sulphate of alumina with sulphate

of iron, and other impurities. If the iron is chiefly in the state of protoxide, the color is greenish or white, and it is called kahi sabz or safed; but it mostly is peroxidised, and is then termed kahi zard, from its yellow color. Some specimens of kahi are also said to be obtained from the ground. Kahi lál consists solely of bichromate of potash, of English manufacture, and is principally used in dyeing. Two specimens of this were shown in fine crystals (No. 4355, Amritsar).

SULPHATE OF COPPER—NILA TUTYA.

An impure pale blue salt. Is prepared by boiling copper plates with sulphuric acid, and might easily be purified by recrystallizing; but there is also in most bazars some very pure sulphate of European manufacture, as No. 4523 from Amritsar, and No. 784, from Lahore.

ACETATE OF COPPER—ZANGAR.

One specimen, No. 785, from Lahore, was sent. This is said to be of English manufacture, but might be made by placing grape husks between copper plates. It is principally used as a coloring matter.

SULPHIDE OF ANTIMONY—SURMA.

This mineral is extensively used by the natives as an application to the eyelids, either solely for appearance or with other substances as a medicine. It has been already remarked that under the name surma many substances are supplied, especially the sulphuret of lead, the sesqui-oxide of iron, and occasionally bin-oxide of manganese; while the name "surma safaid" is usually applied to calcspar, carbonate of lime, and sometimes to sulphide of lime or gypsum.

ARSENIOUS ACID—SANKHYA.

Some very fine specimens of this deadly poison were shown, in particular one of vitreous arsenious acid, by B. POWELL, ESQ. (No. 806); a large number of different compounds containing arsenic are shown.

ORPIMENT—HARTAL.

A very fine specimen of this substance divisible into thin plates, called "hartál warkí," was shown from Lahore; other specimens were more massive; varieties of this, called hartál píli and gulábi, were also shown.

REALGAR—MANSIL—BISULPHURET OF ARSENIC.

There were also several boxes of this poison; one kind naushádar kání, (No. 816,) Lahore and (No 753) Amritsar, deserves especial notice, as it might be confounded with sal ammoniac by its name, and lead to injurious results.

OXIDE OF LEAD—MURDA SANG.

This is said to be made at Lahore and Jágadrí, and it might be well employed in making lead plaster (strapping) with some of the country oils; other preparations of lead also might be manufactured from it.

READ LEAD—SANDHUR.

A specimen of this, (No. 753,) and one of carbonate of lead, or safaida, (No. 779,) were both shown from Lahore; but were probably manufactured in England.

MERCURY—PARA.

Two rather impure specimens of this liquid metal are shown, (No. 764,) from Amritsar; the other, (772,) from Lahore: they are chiefly important as a source of the preparations of this drug, namely :—

CALOMEL—RASKAPUR.

(No. 775, Lahore). This is a very pure specimen, quite free from any soluble corrosive sublimate, which is generally contained in bazar specimens of raskapúr, and often is present in poisonous proportions, unfitting such for medicinal use.

CORROSIVE SUBLIMATE—DAR CHIGNA.

Some very fine specimens of this powerful remedy were also shown, as No. 748, from Amritsar, and No. 775, from Lahore.

NITRATE OF SILVER.

A rather dark looking specimen of this salt, which is now made at Lahore for photographic purposes in much purer form, was shown, (No. 842,) and called "kástak" (this term is a corruption of "caustic").

LIGNITE—SALAJIT.

Several specimens of this fossil were shown as native medicines; they are without any real value for medicinal use.

PETROLEUM—MITTI KA TEL.

A fine specimen of this valuable fuel was shown, No. 876, from the Lahore Museum; if the experiments which are now being carried on in England prove that it can be used as a substitute for coal, this substance may become of the greatest importance; but at present its employment is extremely dangerous. In medicine it is chiefly employed to apply to the skin.

AMBER—KAHRUBA.

Two fine pieces of this substance were shown from Lahore.

MINERAL ACIDS.

SULPHURIC ACID—GANDHAK KA TEZAB.

(No. 888) is made at Lahore for the purposes of dissolving indigo, and the energetic native who prepares it has not only constructed a leaden chamber for the purpose, but has imported a platinum retort from England in order to concentrate it sufficiently. The acid is therefore supplied quite free from coloring matter, and of any strength that may be required; it contains however a quantity of sulphate of lead.

NITRIC ACID.

Is made in two ways in Lahore: the best by acting on pure nitrate of soda with a quantity of sulphuric acid. This sort is used for the purification of silver, and the formation of the nitrate. A less pure kind is made by the action of kahi (impure sulphate of iron) on nitre, but this is rather a mixture of nitric and hydrochloric acids, and will dissolve gold leaf. Both specimens are shown, No. 889 and 891, from Lahore.

HYDROCHLORIC ACID—NIMAK KA TEZAB.

Is made similarly to nitric acid, substituting common salt for the nitre.

The following substances included in the British or London Pharmacopœia are represented in a more or less pure state among the medicinal drugs present in the Exhibition.

English Name.	Native Name.	Remarks.
Sulphur,	Gandhak,	
Sal ammoniac,	Naushádar,	
Nitre,	Shora,	Of various qualities.
Carbonate of soda,	Saji mitti,	Very impure.
Common salt,	Nimak,	
Borax,	Sohága,	
Lime,	Chúna,	
Sulphate of lime,	Sang-i-jaráhat,	
Carbonate of lime,	Kharya mitti,	
Binoxide of manganese,	Jugni,	
Zinc,	Jast,	
Oxide of zinc,	Missi safed,	Very impure.
Iron,	Loha,	
Magnetic oxide of iron,	Chamak pattar,	
Sesqui-oxide of iron,		
Sulphate of iron,	Híra kasis,	
Copper,	Támba,	
Sulphate of copper,	Nila tútya,	
Acetate of copper,	Zingár,	Of English manufacture.
Bichromate of potash,	Kahi lál,	" "
Sulphuret of antimony,	Súrma,	
Tin,	Kala'i,	
Lead,	Sísa,	
Litharge,	Murdá sang,	
Red oxide of lead,	Sandhúr,	
Carbonate of lead,	Safeda,	From England.
Mercury,	Párá,	Impure.
Calomel,	Ráskapúr,	Often contains sublimate.
Corrosive sublimate,	Dár chigna,	
Nitrate of silver,	Kástak (corruption of caustic),	
Orpiment,	Hartál,	
Realgar,	Mansil,	
Arsenic,	Sankhyá,	
Silver leaf,	Wark nukra or chandi,	
Gold leaf,	Wark tilá or soná,	

The above include all the specimens shown in this collection, which if carefully prepared and purified, would be of service either in medicine by themselves or to prepare other drugs with.

Among the prizes which the jury have to allot is one offered by H. H. Rajah of Kapurthalla of Rs. 200, "For any chemical preparation, cheap and simple, that shall effectually neutralise the saline ingredients so abundant and injurious in many parts of the Punjab, and render the soil culturable." The jury are of opinion that no preparation has yet been proved to neutralise the ingredients spoken of, and that they would recommend that his Highness the Rajah of Kapurthalla should be requested to allow the prize to remain in abeyance until some effectual experiments can be tried, and that the prize should then be offered for any process that would accomplish the desired result. The jury strongly recommended that a silver medal be awarded for the very extensive and carefully arranged collection of drugs from Lahore, and also award a prize of two shares for the mineral acids exhibited in the Lahore collection.

In conclusion, the above review of the Mineral Medicinal products shown in the Exhibition, prove how greatly they might be improved by a little European instruction in Chemistry, and at the same time how ready some of the natives are to take advantage of the information which they possess already, and that they procure from England substances they are unable themselves to make.

Thus, in the first place it has been necessary to record that many salts, as carbonate of soda and potash, sulphates of iron and of copper, are only shown of native manufacture in an impure state, because the manufacturers are not aware of any cheap means of purifying these; nevertheless, attempts have been made to prepare several substances requiring a certain amount of chemical knowledge, such as nitrate of silver, cyanide of potassium, and the mineral acids; and, lastly, pure salts, as sulphate of copper, acetate of copper, and also carbonate of lead, chromate of lead, and bichromate of potash, are procured from England for use.

It may be thought by some that it would be cheaper to manufacture all medicinal agents in England than to make them in Lahore, and probably this may be the case if they are only used in medicine, and are capable of being conveyed in a solid form; but there are several substances which are either required in larger amount, since they are used in the arts—such as alum, the mineral acids, sulphate of iron, carbonate of lead, the oxides of lead, vermillion, &c.; or they are liquid and therefore difficult to convey a long distance by land, as must necessarily be the case in the Punjab—such are sulphuric acid, hydrochloric acid, nitric acid, acetic acid, and solution of ammonia: all these could be made with probable advantage at Lahore; also there are many impure salts shown which could be readily rendered more pure, and therefore more useful. Should a school of arts be formed at Lahore, it is to be hoped that arrangements may be made in the shape of furnaces, &c., to instruct some of the more energetic "pansáris" of the city at that establishment, in the necessary processes for preparing these and similar substances. During the Exhibition several were anxious to enquire respecting the manner in which preparations from England, shown in this collection, were prepared, and what precautions ought to be taken in order to manufacture similar specimens; and much benefit might result if suitable instructions were given.

T. E. B. Brown, M.D.,

Reporter

Division V.—Substances illustrative of the Geology of the Province.

SUB-CLASS (A). FOSSILS.

The reader will kindly remember that the following brief and imperfect notice of a few of the fossils sent to the Exhibition of 1864, makes no pretence of being scientific or complete: it is indeed obvious that the list only includes a very few of the species either of Mammalian and Molluscous remains which are to be found in the hills of the province; besides this, there are large tracts of country whose fossils and rock formations are entirely unrepresented. I debated for some time whether these sections ought to be printed, but eventually I determined to let them stand, principally from unwillingness to exclude from mention, the interesting collections of Mr. Philip Egerton and Dr. Costello.

In the same way, the geological sketch of the Punjab hills which follows, is solely intended to convey a brief and general idea of the hill formations to the unscientific reader, and to indicate the direction in which he may pursue the study of the subject. If it falls into the hands of a geologist, I must beg of him to forbear criticism on so imperfect a delineation. The geology of the Himálaya and its subsidiary mountain ranges might form the study of a lifetime, without being exhausted. Certain parts of this vast chain of mountains have indeed been studied, especially the lower formation of the Siwálik range, in connection with which the names of Falconer and Cautley are familiar to all. Other portions of the Himálaya, together with the hills beyond Peshawur, the Safed Koh, Hindu Kúsh, and Sulaimání ranges, are almost unexplored, and the only published accounts of their geology are to be found in a few scattered and brief notices in the travels of Vigne, Jacquemont and others, and in several papers of the Asiatic Society. The same is true of the hills in the Delhi and Gurgaon districts; the geological age of which has not yet been determined. At present, therefore, the materials at command for compiling a sketch of the geology of the Punjab are but imperfect; and this fact may also be adduced as an apology for the imperfection of this division. Among the fossiliferous districts the only ones represented are;—to the north, the Spiti ranges, and lower down the Siwálik hill range, at Haripúr, Sujánpúr, Nadaun in the Kangra district, and several places in the Ambálla and Hushiyarpúr districts. Further west the hills about Simla are sparingly represented. The whole district thence onward to Peshawur and the Hindu Kúsh is quite unrepresented. The Salt range, which runs transversely between the Jhilam and the Indus, is not represented as far as its fossils are concerned, unless the Baloti range, and Shaikh Budín hills are considered as a portion or continuation of the range Trans-Indus; it is, however, from these lower hill spurs, that the finest series of fossils is exhibited. These hills lie in the vicinity of the Salt range; having those hills on the south, the Peshawur hills on the north, and the end of the Sulaimán range with the Wazírí hills on the west. From this place onwards down the western frontier, the branches of the Sulaimán range are occasionally represented. Dera Ghází Khán exhibits several fossils, from the Lagári Mazári, and lower hills belonging to the Sulaimán system.

On the other border of the Punjab territory, but not geographically within it, come the hills of the Delhi, Gurgaon, and Hissar districts. These are the systems of low hills known as the Delhi hills, beginning to the south-west of the district; they also to some extent, include the Shekawati hills, which form a portion of the Gurgaon district, and are eventually confused with the Aravalli range. Some of these hills are fossiliferous, others yield metals;—the copper of Hissar and of Singháná in Gurgaon district, belonging to this series. In other portions marbles and freestone are found; and the Kalyána hills of Dádrí, now included in the Jhind territory, furnish elastic sandstone.

Most of the stones exhibited are included in the previous divisions, on account of their economic value as building materials, &c.; and there remains for this division only the fossil series, and a few samples of boulder stones and unutilized rock, together with some curious lime formations of petrified substances, concretes, and stalactitic deposits.

The ranges of hills thus enumerated furnish not only the fossils, but the whole mineral products of the province. All the plain districts consist of an alluvial clay soil, the analysis of which is given in the sequel. The products of the plains are kaukar, or calcareous concrete, which is dug for in the soil of almost every district in the province, and which supplies both a material for making roads and flooring, and also a substance from which lime can be made. Pottery clays for coarse earthen ware, tiles, &c.; and saltpetre, which efflorosces from the soil, conclude the list.

Spiti Pass and Hills.

570.—[205]. Fossils. Mr. George Jephson.

I have no account of these.

[306—15]. Series of fossils from Spiti. Mr Philip Egerton.

The series consisted as follows:—

Belemnites.

Ammonites Gerardi,—Class, Encephala Cephalopoda oolitic?

Ammonites Nepalensis (Gray), do., do.

Ammonites triplicatus, do., do.

Ammonites Wallickii, do., do.

Ammonites biplex (Sowerby), do., do.

Ammonites torquatus (Sowerby) do., do.

Ammonites acucinctus (Strachey), do., do.

Ammonites, undescribed,* do., do.

Spirifer striata (Brachiopoda), carboniferous.

Productus——*Sp.* (Brachiopoda) carboniferous.

Pholadomya (Acephala), oolitic.

Nucula cuneiformis (Sowerby) (Acephala), oolitic.

Rhynconella cynocephala (Brachiopoda) carboniferous.

Orthoceras? (Cephalopoda), carboniferous.

Astarte major, (Acephala), oolitic.

Mr. Egerton's collection is from Spiti and the Peen valley, at elevations of from 15,000 to 17,000 feet.

* This might be provisionally called *A. Egertonii.*

Siwalik Hills.

Simla.

571.—[183]. Fossil bones. Sirmúr. The Rana of Sirmur.

572.—[198]. Ammonites and sea shells, village of Themar. Mr. S. Berkeley.

Kangra.

573.—[267-68]. Fossil shells, from Haripúr, Núrpúr, and Nadaun. Local Exhibition Committee.

The series [267] from Núrpúr, contains some very recent fossils. A species of *Unio* closely resembling the ordinary river mussel, in which both the epidermis and under pearly substance is completely preserved, is among the series, as also a number of spirals. There is also a species of *conus*.

The series from Núrpúr also embraces a number of fossil bones; some portions of the scapula of a small animal, the tread of tibia or ulnus of some animal: several portions of ribs. There is also a portion of a bone, hollow, and having a black color, which looks like the bone of a bird.

Amballa.

574.—[173]. Fossil bones, &c., Náhan. Local Exhibition Committee.

Sulaiman Range.

This series is very poorly represented, nor has the range yet been explored: the vicinity of wild marauding tribes renders geologizing perilous.

575.—[542]. Fossils, from Lagári hills. Imam Bakhsh Khan.

Dera Ghazi Khan.

Consisting of *Belemnites*, a species of *Natica*, and several species of *Echinus*. The curious trilinear markings on the latter, are compared by the people to the impression of a bird's foot: to which, accordingly, they attribute the origin of these fossils. Among the fossils were included a series of stones which are not organic, but had been worn into singular shapes by the action of water.

[ ]. "Saugcha," nummulites. Mazári hills. Imam Bakhsh Khan.

The natives have a story with regard to the larger fossils of these hills, that they are the petrified clothes of fifty betrothed virgins, who were once surprised while bathing by their future husbands; they prayed heaven to grant them a covering; in answer to this the earth swallowed them up, and their clothes became stones!

Shaikh Budin Hills.

576.—[17-99]. Series of fossils from the Sand Hills, which run eastward from Shaikh Budín towards the Indus. C. Costello, Esq., Assistant Surgeon, 6th P. N. I.

These sand hills rise somewhere east of Shaikh Budín in the Marwat Iláka of the Dera Ismail-Khán district, and run northward parallel to and along the banks of the Indus, until they meet with the same series belonging to the Salt range.

Pith of fossil tree, } (Monocotyledonous).
Outer bark of ditto, }
Inner bark of ditto, }
Head of thigh bone of a large mammalian.
Head of a mammoth (elephas primigenus).
Detached teeth of ditto.
Portion of head of an elephant.
Head of mammoth.
Humerus of a large mammalian.
Hip bone of a large mammalian.
Sacrum of ditto.
Upper portion of sacrum.
Sacrum of a mammalian.
Portion of coccyx of ditto.
Lower extremity of femur of ditto.
Head of humerus of ditto.
Portion of head of a mammalian, probably a temporal bone.
Portion of ribs of a large mammalian.
Ditto of tusk of an elephant.
Patella or kneecap of a large mammalian.
Lower end of humerus of ditto.
Lower end of tibia of ditto.
Upper end of ditto ditto.
Lower end of radius.
Ditto of femur.
Vertebra of a large mammalian.
Atlas, or 1st cervical vertebra of ditto?
Axis, or 2nd cervical vertebra of mammalian?
Scophoid bone of ditto.
Astragalus of a large mammalian.
Tooth of mammoth.
Fossil sternum.
Tooth of *Bos sp*——?
Portion of jaw of some herbivorous animal. *Bos sp*——?
Tooth of ditto.
Molar tooth of *Hippopotamus Sivalensis*.
Tooth of *Dinotherium* (Kálábágh hills).
Portion of horn of a deer.
Portion of horn or tusk.
Portion of jaw of a herbivorous animal.
Portion of fibula of a mammalian.
Vertebra of ditto.
Lower end of fibula of ditto.
Ditto of radius.
Portion of a phalax.
Portion of tusk.
Lower jaw of some carnivorous animal.
Another portion of the above.
Pieces of teeth of the above.
Soft sandstone from which the above fossils were procured.
Coprolite (?) This appears to be a stone worn by weather, and looks like a coprolite, but is not organic.
Belemnites.
Several species of *Pecten* or *Janira* (species undiscribed).
Cidaris Verneiulii (tertiary), Echinodermata.
Terebratula sp——?
Shelly limestone, with *Rhynconella pleurodon*; foot of the hills on the Pannyála side (oolitic ?)

Balut Range.

577.—[80-100]. Collection by Dr. Costello.

Productus Costatus (Class, Brachiapoda), carboniferous.

Productus cora, do. do.

Athyris Roissyi (Leveille), do. do.

Athyris subtilita var *grandis*, do. do. (Davidson, Quar Journ. Geol. Soc. Lond. 1862, p. 28, pl. I. fig. 7-8).

Orthis resupinata (Class, Brachiapoda), carboniferous.

Rhynconella pleurodon, do. do.

Rhynconella sp———— ? do. do.

Rhynconella cynocephala, do. do.

Spirifera striata ? do. do.

Spirifera sp———— ?

Streptorhynchus crenistria, do. do.

Streptorhynchus pectiniformis, do. do. (Davidson, Quar. Journ. Geol. Soc. Lond. 1862, p. 30, pl. I. fig. 17).

Lithostroton irregulare (Zoophyta), carboniferous.

Ceriopora sp ———— ? (Bryozoa), carboniferous.

Anomia Lawrenciana (Acephala) carboniferous ? (De Konnick, Quar. Journ. Geol. Soc. Lond. 1863, p. 6, pl. IV. fig. 7, 8, 9).

Lima gigantea ? (Acephala), oolitic.

Pecten (or Janira) sp———— ? (Acephala), oolitic ?

Venus subaylauræ (Davidson), (Acephala), tertiary (Shaikh Budin).

Natica Flemingii (Sakesar in the Salt range) (Eucephala Gasteropoda), tertiary.

[It should be remarked that almost the entire collection of shells and zoophytes was wrongly named in the original Exhibition list. The identifications here given are chiefly by Dr. Oldham.]

SUB-CLASS (B). MISCELLANEOUS SPECIMENS OF ROCKS, &c., NOT BEING AS YET OF ECONOMIC VALUE.

578.—[1]. Ferruginous rock. Sahi Balabgarh. MUNICIPAL COMMITTEE.
Delhi.

579.—[ ]. Stalactites, from Spiti.

580.—[298]. Stalactites, from Sujánpúr Tera. LOCAL EXHIBITION COMMITTEE.
Kangra.

These are samples of a claystone covered with a deposit of lime.

581.—[299]. Sample of a gray limestone rock containing patches of carbonate of lime, and containing hollows; the sides of which are covered with quartz, in minute crystals. Spiti. P. EGERTON, ESQ.

582.—[305]. A pink sandstone, like "new red." Spiti. P. EGERTON, ESQ.

The edge of the sample is waved in a curious manner as if there were some fossil remains, but the sample is two small to discover.

583.—[552]. A number of small hard round stones, from the Wazírí hills.
Bunnoo.

584.—[559]. A series of rolled round fragments of hard rock, incorrectly termed in the original list, fossils.

585.—[447]. A sample of rolled, quartz rock, from Bucha, Rawalpindi. LOCAL COMMITTEE.

There are some other samples of river rolled stones, from Gujar Khán and Káshí Walla.

GEOLOGICAL SKETCH.

HAVING now recorded the specimens included in the collection, I proceed to a brief sketch of the physical geography and geology of the mountain ranges of the Punjab. Such a sketch seems almost necessary in connection with a class of mineral products derived from various localities, and which, unless the reader is put in possession of an outline showing the relation of one place to the other, would appear to be a mere miscellaneous series without any internal order or relationship.

The hills to be considered are first—The Himálaya, or properly speaking the portion of the western Himalaya which bounds the Punjab; this will include the secondary formations of Spiti and the Kuenluen range; next the subordinate group of hills, and especially the fossiliferous strata of the Siwálik and corresponding formations; next the Salt range, and the geologically related hills of Kálábágh, Shaikh Budín and Balút. Then come the Sulaimán hills, and the hills of the Safed Koh (Peshawur district); and lastly, on the other side of the province altogether, the hills of the Delhi and Gurgaon districts.

And first of the Himálaya:—The great mountain barrier to the north of our Indian empire is well known by the name of the Himálaya or Himálch. It consists not of one but of a vast series of ranges; those towards India form the Himálaya proper; those towards Tibet and Central Asia, forming the Kuenluen or Tibetan chain still loftier than the Himálaya.

The Himálaya includes only those mountains below the line formed by the Indus and Brahmaputra rivers. A glance at the map will show that these two rivers rise close to each other, but flow in directly opposite directions, forming a long line till at either end of the chain, each river turns abruptly south; these form the limits of the Himálaya proper. It may be generally remarked that the secondary chains on the south face are of much greater importance than those on the north.

Thus defined, the Himálaya may be divided into eastern, central, and western ranges. It is the latter division alone that is immediately connected with the Punjab, and which can be taken into present consideration.

To any one desirous of obtaining a general brief sketch of the eastern Himálaya as a chain, I would refer him to the Introduction to DR. ROYLE'S Illustrations of Himálayan Botany; to the Introductory Essay to HOOKER and THOMSON'S Flora Indica; and to a valuable, but not easily obtained, paper by MR. HODGSON, on the Physical Geography of the Himálayas, published in the Asiatic Society's Journal, August, 1849, No. XXII. Besides these, I need only allude to the books of CUNNINGHAM, HERBERT, STRACHEY, and HOOKER; as well as for general information, apart from geology, to the travels of HUGEL, BURNES, STERLING, VIGNE, JACQUEMONT, GERRARD, and others.

The chain of mountains on the north-east of the Punjab is also partly Tibetan partly Himálayan.

Taking as our starting point the great peaks * above the Mansarowara lake, near the 82nd parallel of longitude and 31st of latitude (roughly estimated); we find a marked chain, containing the Karakorum mountains, running north-east. This range forms the northern boundary of the provinces of Balti, Nubra, Pangong and Nari-khorsum. Another range below this forms the boundary of the provinces Guge, Ladákh and Dras. Below this runs the Indus, and then, enclosing the valley of the Indus, is another chain, which forms the boundary of the provinces of Dras, Zangskár and Parang; below these is the central range of the real or Indian Himálaya. Between the ranges, just mentioned, there are of course a vast system of subordinate chains varying in height. It may be remarked with regard to these, that the subordinate ranges exhibit much greater tendency to parallelism than to the normal idea of subordinate chains forming principal valleys at right angles to the main axis. This was noticed many years ago by JAMESON in his examination of the mountains between Bhár and Simla.†

The main range of the western Himálaya, commencing about Mansarowara, and running north-east,‡ terminates at the great peak (20,000 feet) of Dáyámár, or Nanga Parbat. Here the range rapidly sinks to-

* Natives call *all* the high snowy peaks of the Himálaya by the generic name Kailása. Hence the "Kailás peak," is rather unfortunate as a specific denomination.

† Remarks on the Geology of the Country between Bhár and Simla; *see* also Introduction to ROYLE'S Illustration, p. xvii.

‡ Introductory Essay Flora Indica, p. 190.

wards the Indus. At this point also the two ranges which enclose the Khágán valley (traversed down the centre by the Nainsukh river) strike off in a south-easterly direction, and separate the Himálaya from the system of the Hindu Kúsh and Safed Koh, beyond and below it. Of the latter ranges I shall speak presently.

The central range of the west Himálaya runs nearly parallel to the Indus, and some distance south of it. The provinces which it bounds are Kanáwar and Spiti, Lahaul, Kishtwár, Kashmír, and near the Indus the tract of hill country represented by Hazara and Marrí. The most remarkable pendant to this central chain is the vast chain of mountains, which, starting off near the 76th parallel of longitude at the Shesha-Nâg peak, runs round, enclosing an irregular elliptical space, and rejoins the original range, midway between the 75th and 76th parallels. The amphitheatre thus formed is the Kashmír valley; the mountain ranges enclosing it, which form as it were a loop depending from the main line, are known by the name of the Panjál, or the Pír Panjál, the Snowy Panjál, the Panjál of Bánihal, &c., &c. This chain of hills separates Kashmír from Kishtwár on the east, and from Hazara on the west. The eastern portion of the central range, has another range parallel to it on the south, enclosing the Chandra Bhaga or Chináb, and forming the valley of that river between Kishtwár and the Tarí pass, at the 78th parallel of longitude. The remaining subordinate ranges are more easily considered with reference to the rivers which run among them. First then, there is the Cis-Sutlej Himálaya, which runs downward towards the plains separating the Ganges basin from the valley of the Sutlej. Simla is situated in this chain. Next comes a series of hills bounding the valley of the Sutlej, and separating it from the valley of the Beás, including the Suket and Mandí territory. Beyond this, comes the Dhauladhár range (in which are Dharmsala and other well known places), separating the valley of the Beas from Chamba and the valley of the Raví; and then a system, rather than a definite chain, of hills separating the Raví from the Chináb.

Beyond the Chináb river and to the south of the great Kashmír valley, are a varied series of hills running off from the Panjál mountains, and forming the elevated country between the Chináb and Jhilam, including Rajauri. Beyond the Jhilum we have a continuation southward of that long mountain series which forms the Himálayan wall of the Kághán valley. On this is situated the well known hill station of Murree: this range may be taken as almost the limit of the Himálaya. Beyond this we have the whole hill country of Hazara up to the Indus.

This of course is only a highly generalized and imperfect sketch of the chains of the western Himálaya. Besides the ranges, which I have indicated, there are endless subordinate divisions, some of which are so important as almost to obliterate (so to speak) the demarcation above adopted. No doubt the safest key to the intricate range is the principle of observing the valleys of the great rivers, and the ranges by which they are separated.

The published maps including the Himálaya, are a source of great difficulty to the student. Scarcely two of them are alike. This is a difficulty not easily got over, since it is obvious that if in the map only the principal ranges are given, each topographer will give what *he* considers to be the principal chains, and omit the details: consequently, as each man's view differs as to what are the principal chains, so will the maps differ; one puts in prominently what the other leaves out: hence the endless variety observable. Other maps again are so full of subordinate ranges strongly marked, that the whole Himálayan tract appears to be a net-work too intricate to distinguish one range from another. These are only difficulties of drawing; but if we take into consideration the actual inaccuracies of the maps themselves,—unfortunately only too common,—the confusion which results is incalculable.

It is impossible here to attempt anything like a systematic geological account of the mountains thus described, for the simple reason that until a regular geological survey of them is made, it is only in detached portions of the hills that we have the published accounts of individual observers, and haply a few collections of rocks and fossils to guide us.

The collections of the Exhibition of 1864, and those of the Lahore Museum, contain specimens from a few localities, showing the rocks which form the principal portions of the higher range of the west Himálaya. These consist of granite and syenite, and below that of talcose and chloritic schists and slates, and other metamorphic rocks, interspersed with dykes and interruptions of trap, amygdaloid, and various volcanic rocks, pebbles of which are found in the hill streams and in the beds of conglomerate in the lower ranges. Below these come tertiary formations of various sandstones and clays, as well of conglomerates formed of fragments of the metamorphic, volcanic and primary rocks of the higher ranges. These huge beds contain boulders often of immense size, which must have been transported by glacial agency; the conglomerate often forms whole cliffs cut into fantastic shapes by water action.

The secondary, oolitic, and carboniferous formations are mostly within the Tibetan mountains of the Kuenluen; in British territory they are solely represented from the little province of Spiti, which

forms the most north-eastern of British Himálayan possessions. These classes of rocks have been as yet but little studied in the Himálaya. The whole of the Sub-Himalaya ranges, through Rajauri, Jammú, below Chamba, Kangra and Simla, are entirely occupied by tertiary formations of sand, clay and conglomerate; and below these again, or more properly speaking, intermingled with them, are hills of fossiliferous tertiary formations.

It should here be observed that the fixed gradations of true Himálaya,—dhún or valleys,—sandstone or Sewalik range,—" bhaver " or forest tracts, and lowest of all the Tarai, which consists of arid tracts or else swamps at the foot of the mountains,—which are so constant and marked in the central Himálaya, are not observable at all in the Punjab.

With regard to the sandstone range, intermediate between the true Himálaya and the plains, there is, no doubt, a range that must be considered *boná fide* Siwalik beyond the Jumna, which extends west of Náhan and Pinjor, as far as Rúpar, in the Ambála district. But we have no " dhúns " and no " sál forest tract " (except slightly in Hushyarpúr and in Ambála). Below the true Himálayas come ranges of low hills, covered with brushwood, *Adhatoda vasica*, and other shrubs, which gradually subside towards the plains. Every one who has been through the Gurdaspúr, Kangra, Hushyarpúr, and Simla districts, will remember this. With regard, however, to those remarkable Siwálik fossiliferous ranges, it is quite true that here and there at very irregular intervals, tertiary strata having gigantic mammalian remains, characteristic of the Siwálik, may be found across the whole width of the Punjab, and can be traced through the Shaikh Budín hills, and the spurs of the Safaid Koh, even into the Sulaimání hills.

Thus, travelling from east to west, we find fossiliferous strata at Náhan (Ambála district) Nadaun, Haripúr, and Núrpúr (Kangra), then at Kotli and throughout the Rajauri tract, including the Pabbi hills and thence onward to the Kálábágh hills, the Balút and Shaikh Budín hills, and the hills of the Lagári and Mazárí tribes of the Derájat in the Sulaimán range.

The hills beyond the Indus, form a series of hills almost like a continuation of the Himálaya.

HUMBOLDT considers the Hindú Kush to be a continuation of the Kuenluen. DR. ROYLE remarks that from DR. GERRARD'S and LIEUT. BURNES' journey between Kábul and Bálk, it appears " that the rounded nature and secondary formation of these hills rather resembles the (Tibetan) mountains to the northern of Kunáwar than the primary structured Indian Himalaya."* These hills include the province of Gilghit, and below it Kuner: and indeed the hills beyond Peshawur, including the Bajaur hills famous for their iron, are but branches of the Hindu Kúsh. The range of hills below the Hindu Kush are the Safed Koh, from which numerous spurs descend, connecting the Sulaimán range and Bilúchistán hills.

* ROYLE'S Illustrations. Introduction, p. xi.

It will now be proper to present a sketch rather more in detail, but still very imperfect, of the various hill ranges and their productions. Of the Himalaya, including that very large portion of it, which consists of primary, metamorphic, and non-fossiliferous rocks, I can here give no further account. Throughout the class of mineral products previously described, are to be found scattered notices of the granites, slates, sandstones, brought from various parts of it.

Of those parts of the chain, which are of secondary formation, we have but little knowledge. The Spiti province is alone the representative in the collection of these rocks; and to the description of this remarkble province I at once proceed.

Spiti* forms a valley in the extreme north-east angle of our territory, the inhabited portion is said to have an elevation of nearly 12,986 feet

The valley of Spiti was annexed principally with the view of preventing the evils which would result from allowing a foreign territory to intervene between the districts of Kangra, &c., and the wool producing valleys beyond.

" Spiti is approached," says CAPTAIN HAY, " from our own territories and Kanáwar, by six different routes, and from Ladákh and Tartary by three routes, through the two chains of mountains; many of the passes are at great elevations, varying from 14,000 to 18,000 feet."

Spiti is bounded on the north by the Parang range, separating it from Ladákh: to the north-east by inaccessible mountains; on the east, a valley called Kurateetakpo separates it from Chinese Tartary; on the south and west, it is enclosed by the portions of the snowy range, dividing it from Bishahr, Kúlú and Lahaul.

There are three transverse valleys along these hill series, which constitute the whole of the inhabited portion of Spiti: one extends from the portion of the north-west range called Báráláchi, to the Bhúba pass in the direction of the curved line of mountains. About 30 miles of this valley are inhabited, from the river Spiti to the last village. Moodh, the second valley, extends from the Spiti valley in the direction of that

* MR. PHILIP EGERTON has recently published " A Journal of a Tour through Spiti," which, besides the interest of the information contained in the letterpress, is further valuable from being illustrated with photographs taken on the spot.

curve of high mountains separating Spiti from Chinese Tartary. The third valley is known by the name Parang, from its leading up to the Parang pass.

The valley of Spiti is watered by the Spiti river, (whence it takes its name,) which, after flowing a considerable distance, divides into two branches. The Spiti is fed by several small rivers or streams, having their origin in the surrounding hills.

The following geological account, is extracted from CAPTAIN HAY'S account previously alluded to.

"The formations that I have seen belong wholly to the secondary period: in fact, Spiti may be described generally as being of various kinds of lime and sandstone, with a few slates, shales and conglomerates. On descending into the bed of the Spiti after crossing the range which separates it from Kanawar, beds of red sandstone are first met with: in connection with these below Lara is gypsum and alum (sic) [alum shale?] From the water all the way from Lari to Dunkur being saline, I have no doubt but that rock salt may be discovered in the vicinity of the gypsum.

"These secondary strata contain some excessively interesting fossil beds, the first which I examined are in the Peenoo valley, and above the village of Mekeedon; they are a marine deposit, and belong to the "poikilitic"* group, being situated between the beds of the lower new red sandstone and the magnesian group, or dolomite conglomerate; these again being associated with beds of shale and mountain limestone, point it out as an exceedingly likely locality for coal. The fossil beds of ammonites are of great extent, the shells varying from the size of a cart wheel, to an inch in diameter. In a very short time I collected as many as two men could carry, and could distinguish as many as six or seven different species of ammonite with a variety of other shells, and one or two vertebræ of fish.†

"A large quantity of red earth (red oxide of iron) is found somewhere in the vicinity, which is used by the people for ornamenting their houses and marking their sheep, &c.

"The other fossil beds which I examined are in one of the valleys near the village of Gieumull. The formation corresponds with the well-known lias and lower oolite, reposing on the lias. The mountain behind which these beds are situated, is composed of a series of calcareous and sandstone beds, in an almost undisturbed position.

"The decomposing lias beds mixed with much indurated mud clay, and generally tinged with iron, have greatly the appearance of a coal field, and are on undulating hills; these are filled with ammonites of only one species. The decomposition of this group forms the richest ground in Spiti; the soil at Ludung and Lara seems also to be of this description, but the fossils are not so abundant. The lower oolite reposes on the lias, and is composed of rather complicated strata, containing immense quantities of shells in a black deposit of extreme fineness; this clay is perhaps an indication of the neighbourhood of coal. I procured a quantity of these fossils, consisting of a variety of bivalve shells, one or two univalves, and varieties of 'orthoceras' and belemnites.

"The mountain limestone is the most abundant formation in Spiti, and abounds with species of *Ammonites*, *Orthoceras*, *Spirifer*, *Terebratula*.

"Some of these beds may perhaps be attributed to the primary fossiliferous or silurian group. They are in a horizontal position, and have never been disturbed since their deposition, and they are in a dark gray argillaceous deposit, below which a slaty sandstone is met with; the fossils generally being *Pentamerus*, *Tentaculites*, *Ammonites* and *Belemnites*, all indicative of the silurian group.

"The productive soil of Spiti is in general calcareous. As far as Ludung, it is of a light color; from Lee to Kee, the soil is blackened by the fossils; and above these places to the head of the valley, the soil assumes a reddish appearance, from its being more or less mixed with the decomposing siliceous particles of red sandstone. The soils are all light and easily turned by the plough; and would, if properly watered, be highly productive. It is a fact to be noted that Herbert, in his mineralogical survey of the Himálaya, travelled as far as the Hung Rung pass in Kunáwar, and leaves it with a remark that 'limestone is never in these mountains a principal formation;' now the principal limestone formation is only there just beginning, but the whole of Spiti may be said to be a limestone formation: likewise a great part of Lahaul. Herbert also says, after mentioning the formations of gneiss, &c., 'that outside of the whole are very limited examples of secondary strata.' Now the secondary strata are of great extent, but not as observed by him. The secondary strata begin at the Hung Rung pass, which is a mere spur from the higher mountains, chiefly composed of limestone and sandstone, as the boulders in the river at Soongnum might have pointed out: but HERBERT merely sighted the limestone, and hence in my opinion drew an incorrect conclusion.

* See LYELL'S Manual of Elementary Geology, p. 334 (ed. 1855). Where the term is explained.

† See No. 566, where the species of ammonites from Spiti are enumerated.

"The Bara Lacha and many other mountains, from 16,000 to 20,000 feet high, are secondary, though certainly very uncommon heights for secondary mountains. It will be a natural conclusion, that the whole range bounding the Tartar plains in this direction are secondary, or certainly not older, which would give us as great a breadth of secondary as of primary formation."

Next we are to notice the lower formations, including especially the Siwálik range.—This is a Sub-Himálayan range of the later or tertiary formation. What is strictly called the Siwálik, extends in a north western direction from the right bank of the Ganges, and runs parallel to the Himálayan range, forming the boundary of the Doab between the Ganges and Jumna; but the range, in reality, continues beyond this, and skirts the Ambála and Ludhiána districts, and comes to its termination in the Hushyarpúr district. Though this range alone receives the name of Siwálik, yet Dr. Royle observes that hills of a precisely similar nature can be traced all along below the Himálayas from the Sutlej, as far as the foot of the Sikim hills: and it is not difficult to conceive a continuation of them more or less continuous, and of greater or less elevation, along the whole southern frontier of the Himálayan system, a distance of nearly 800 miles. At Hardwár, the Siwálik hills form the gorge at which the Ganges issues into the plains of Hindústán. The breadth of this range is at its widest part about 10 miles when it approaches the Sutlej river, and towards its termination beyond that river, the range assumes the form of little more than sand-hills. The highest part of the range is about Hardwár, and to the south of Garhwal, beyond Sirmúr, some of the peaks are as high as 3,000 or 3,500 feet above the sea level. The range is of tertiary formation—all alluvial, and in many places consisting of beds of gravel and rolled stones,—fragments of the older formations of the Himálayan range above, consisting of granites, limestone, clay-slate, gneiss, mica schists, &c. Besides these there are beds of loose grained sandstone, with much mica interposing; there are also beds of calcareous conglomerate and subordinate beds of clay. On viewing these hills, it is difficult to avoid the opinion that they must have been vast beds formed by the débris brought down by glaciers and other causes from the high range above, and that these boulders and débris were empacted together with calcareous and ferruginous matters subsequently. In many places, the strata may be observed, rising one over the other, the face of one stratum resting on the slope of another, while another straight scarp rears itself on the slope of the first, and this frequently repeated, till on looking down on these abrupt ridges from a height, or viewing them from one of the numerous gorges which cut somewhat diagonally through the range, the appearance presented is that of the teeth of a huge saw.

The slope of the strata varies from 20° to 38°; the abutment being towards the plains on the south, and the slope towards the "dhún," or valley between the subordinate range and the true Himálaya.

The clay and sand beds of these ranges are fossiliferous: shells of the tertiary meiocene period abound, but the chief characteristic fossils are the remains of gigantic mammalia, among which may be mentioned the Sivatherium, a huge creature somewhat similar to the "tapir" of modern days. The name is derived from the Hindu divinity Siva, which gives name to the Sivalik or Siwalik range.

The portions of the range represented in the Exhibition were the cliffs near the Markanda river, which forms the frontier of the Ambála district, and that portion which is included in the Simla and Kangra district, the localities being Náhan, the Sirmúr hills, and further on, Núrpúr and Haripúr.

Dr. Falconer, on his first visit to the Siwalik hills, inferred that they were of a tertiary age, and analogous to the *Molasse*

of Switzerland.* Thirty years of subsequent research by other geologists has not altered that determination, although our exact knowledge of the formation has been greatly extended.

The researches thus begun were followed about the end of 1834, by the discovery by LIEUTENANTS BAKER and DURAND, of the great ossiferous deposit of the Siwaliks near the valley of Markanda, westward of the Jumna, and below Náhun. CAPTAIN CAUTLEY and DR. FALCONER were immediately in the field, and by the joint labors of these four officers, a sub-tropical mammalian fossil fauna was brought to light, unexampled for richness and extent in any other region then known. It included the earliest discovered *Quadrumana*, the *Pliopithecus*, and the *Dryopithecus*, an extraordinary number of *Proboscidia*, belonging to *Mastodon*, *Stegodon*, and *Elephas*; extinct species of *Rhinoceros*; *Chalicotherium*, *Equus* and *Hipparion*; *Hexaprotodon*, *Hippopotamus*, and *Merycopotamus*; *Sus* and *Hippohyus*; the colossal ruminant *Sivatherium*, together with species of camel, giraffe, and new types of *Bovidæ*; also species of *Cervus*, *Antilope*, and *Capra*; *Carnivora* belonging to the new genus *Sivalarctos* and *Enhydriodon*, *Drepanodon* (*Machairodus*), *Hyæna*, *Canis*, *Lutra*, &c.: among the *Aves*, species of ostrich, cranes, &c.: among the *Reptilia*, monitors and crocodiles of living and extinct species, the enormous tortoise, *Colossochelys Atlas*, with numerous species of *Emys* and *Trionyx*; and among fossil fish, *Cyprinidæ* and *Siluridæ*; no less than 25 species of shells occurred, all of which but four are now extinct. The general facies of the extinct fauna exhibited a congregation of forms participating of European, African, and Asiatic types. Thrown suddenly upon such rich materials, the ordinary means resorted to by men of science for determining them by comparison were wanting. Palæontological works or osteological collections in that remote quarter of India there were none. But Falconer was not the man to be baffled by such discouragements. He appealed to the living forms abounding in the surrounding forests, rivers, and swamps, to supply the want. Skeletons of all kinds were prepared; the extinct forms were compared with their nearest living analogues, and a series of memoirs by DR. FALCONER and CAPTAIN CAUTLEY, descriptive of the most remarkable of the newly discovered forms, appeared in the "Asiatic Researches," the "Jour. Asiat. Soc. of Beng." (Vol. III. to IX., inclusive), and in the "Geological Transactions."

The appearance of the lower or Sub-Himálayan range, in its relation to the higher or Himálayan series behind it, is well described in the Kangra district by Mr. BARNES. As this fairly represents with more or less accuracy the whole aspect of the two ranges, with the intervening Dhúns or valleys, it will be interesting to transcribe his account:—

"To the north of the lowest range, the hills run into every variety of form and structure. Some rear themselves like mural barriers, and on the southern face present a wild and forbidding aspect. The crest too is rugged and angular, with scarcely room for the foot to tread. But the northern flank will offer the most striking contrast. The descent becomes gradual and easy, and the jungle and rocks which obstructed the traveller on either side, give way to open fields and farm houses, extending in successive tiers to the stream below. Such is the contour of the snowy range itself. Its appearance towards the plains is abrupt and perpendicular, while the northern spurs sweep in long and gentle slopes to the river Rávi. In other parts, again, the entire range will be covered with dense woods unrelieved by a single trace of civilized life; here and there on crags more than usually steep will stand a hill fort once the scene of border hopes and jealousies, but now a mass of dismantled ruins deepening the original solitude of the place. Occasionally the hills subside into undulating knolls, scarcely to be distinguished from the level of the valleys. Here the accessible character of the country has early attracted settlers, and the whole expanse teems with the fruits of human industry.

* Journ. Asiat. Soc. of Beng. 1832, Vol. I., p. 97.

"The distance intervening between these parallel chains is also capricious and irregular. The only valley with any pretensions to symmetrical arrangement is the Jaswán dhún, which is enclosed by continuous ridges from the Beas to the Sutlej, and maintains throughout an uniform breadth and surface. It is not in the Kangra district, but as a part of the same system, influencing and elucidating the other portions of the hills, I have frequently occasion to refer to it. The average width is about ten miles. The limits of the next valley, though less clearly defined, are distinctly traceable from Dutwal on the borders of the Kúlú to Shahpúr on the banks of the Rávi. It runs the entire length of the district and traverses the pergunahs of Nadaun, Haripúr, and Núrpúr; at the south-eastern extremity the valley is little more than a ravine between the ridges that environ it. The surface is extremely rugged and broken, and from point to point is scarcely five miles broad; across the Beas, which intersects the valley at Nadaun, the space widens, and underneath the town and fortress of Haripúr expands into a noble and fertile plain, inferior only to the valleys that skirt the snowy range. Beyond Haripúr, the country again becomes contracted and uneven, and with few exceptions wears the same appearance until it reaches the Rávi."*

Before passing from the northern ridge of mountains, Himálayan and Sub-Himálayan, and coming down in the direction of the Salt hills, and their off-shoots, we must pause to notice that network of hills in the Peshawur district, to the north of the series, which will next engage our attention as the Salt range proper. The hills I allude to may be considered as off-shoots of the Safed Koh range, before described.

Between the Indus and the Swat rivers, the frontier is irregular, the spurs forming numerous smaller vallies, with others running up on both sides, and hemmed in by high precipices, in which secure nooks are located many of the villages of the occupying clans. The hills are for the most part bare, but the higher ones are fringed with pine, and the sides of others are scantily clothed with brush-wood: they afford however good pasturage for the cattle and flocks. In general it may be said that the vallies are intersected by numerous drains from the hills, the sloping banks of which are so perforated and cut up as to form a network of ravines, and a strong natural barrier against the approach of bodies of men not acquainted with the locality. High cultivated ridges occupy the intervening spaces sloping down to these ravines; those nearer the hills being usually covered with a layer of loose stones. The plain outside these vallies is dry and level, with an alluvial soil, falling somewhat towards the Indus and Kabúl rivers, with a high tract of broken uncultivated land extending along the left bank of the latter. This plain forms, with the above vallies, the pergunahs of Yusufzai and Hashtnagar; a strip only from the Kabúl river at Naoshera to Bazar, on the Indus, being attached to that of Khuttak. The large villages of Hashtnagar are situated on the banks of the Swat river, and those of the Yusufzai lie chiefly towards the hills and on the Indus; the vast intervening plain running from the Osman Khail hills to the Indus has but a few small hamlets: it is called the "Mehra," and is cultivated throughout, yielding with but little labor spring crops of great richness.

The Osman Khail and Momund hills, which latter form the boundary of the Doaba pergunah, lying between the Swat and Kabúl rivers are lower, and do not possess the bold and prominent features which mark those of Swat and Bonair. They are destitute of trees and have but scanty vegetation of any kind; a few shrubs are sprinkled about their base, chiefly olive or "kau." Bare, stony, and irregular, they rise abruptly from the plain; their ridges running parallel to the border and not forming vallies as in Yusufzai. Opposite Shubkuddur, at Punjpao, they fall back and form an amphitheatre, occupied by a table land some 3 miles in breadth and 2 miles in depth: stony and intersected by some ravines. They retire again on approaching the Kabúl river, running nearly parallel to it for a few miles and meeting it at Michni. A "mehra" runs along the foot of these hills for their whole extent, varying in depth from 1 to 5 miles. Very little of this is cultivated, but it produces excellent pasture for the cattle of the villages.

From Michni to the Bara river, the Múlagarí and Afridí hills are loftier, but bare and irregular as those of the Momunds. The Tarturra peak, over the entrance to the Khyber Pass, rises to a height of 6,000 feet, and from its summit may be obtained a view of that defile, and a large portion of the Ningrehar valley. The interior of these hills produces great quantities of firewood, but no large trees; their sides are rocky and precipitous. They present the appearance more of groups of mountains than of a connected chain, and from the western limit of the Khalíl pergunah, which is bounded on the east by the Boodni stream, from Michni to Peshawur, and to the south by the Bara river.

From the Bara river to the Kuhat pass the hills of

* Barnes' Kangra Settlement Report, p. 9.

the Aka Khail, and thence to the Jawakai pass, those of the Adam Khail, form the western and southern boundaries of the Momund pergunah; further in they furnish large quantities of firewood, but are bare and rocky towards the plain.

The Khattak range continues the boundary to the Indus, maintaining an average height of from 3000 to 5,000 feet. The higher parts of these hills, though destitute of large forest trees, are clothed with smaller vegetation, consisting principally of the wild olive; the Khattak pergunah is an irregular mass of low hills, between this range and the Kabúl river, a narrow strip of plain only occurring close to the latter, along which the Grand Trunk Road is carried; the villages are situated in defiles and on ledges amongst these hills, and cultivation is scanty.

Dr. Lord was of opinion, from certain geological facts, such as the structure of igneous rocks, poured out under strong pressure, the presence of fossil shells, &c., that the vallies of Peshawur, Jelalabad and Kabúl, were at some former period the receptacles of inland lakes; and that the drainage of these basins, now carried on by the Kabúl river, was in those times effected by the bursting of the mountain barriers. He considered that the shattered fragments and rolled blocks, that strew the Khyber pass, bear testimony to its once having afforded exit to a mighty rush of waters, while the Geedur Gullee, a defile east of the plain, points out the course of the torrent towards the bed of the Indus. In support of this view, Dr. Lord mentions the fact that a well sunk by the Sikhs in the fort of Jumrood, situated at the mouth of the Khyber, passed through rolled pebbles of slate and limestone (the constituents of of the Khyber range) to a depth of 200 feet; whilst the wells of Peshawur, 14 miles distant, are generally 20 or 30 feet deep, and never passed through anything but mud and clay strata. If the plain had once been the basin of a lake into which a stream had poured through the Khyber, the heavier matter with which the stream was charged, would have been deposited at its very entrance into the lake, while the lighter mud and clay would have floated on to a considerable distance.*

The Salt Range is a very well defined group of hills in its western and southern portions. Its elevation is inconsiderable, varying from 2,000 to 5,000 feet at extreme elevations; it is remarkably barren and scanty in its vegetation.

The name of Salt range has been given from its productiveness of the rock salt at the mines of Kheura and other places, an account of which has previously been given. The range is known to natives by a variety of names; we have peaks called Karúli, Kundal, Sardi, Tilla, Bhulla, Kheura, Kas Gabhir, Kas Soj, Sangli and Chitta hills; together with many others both of the Shahpúr and Jhilam districts. The salt range generally, is called "Khawa."

This range runs across the Sind Ságar Doab, between the Jhilam and the Indus, crossing it from east to west, between the parallels 32° 22′ and 33° north latitude, and 71° 30′, and 73° 30′ east longitude. It starts with three spurs or prongs, one on the east bank of the Jhilam and two on the right, both continue separate as far as the Búna nalla, which joins the Jhilam river at Dárápúr and Rasul, and then unite into one range, which continues up to Kálábágh on the Indus.

The first spur or range is on the east bank of the Jhilam, and embraces what are known as the Pabbi and Kharian hills. This spur continues across the river at Dárápúr, joining what is called the Saráfar hills, these are all of miocene formation, and continue up to the Búnah nallah, where they join with the second central spur, called Rohtás. This spurs runs down to the Búnah nallah, crosses it under the name of "Chambal," as far as Jalálpúr, where it meets with the first spur, Kharian, above-mentioned. The third or most westerly spur is called Bakrálá, runs parallel with the Rohtás spur, and then at the Búnna nallah, spreads out forming the Diljabá ridge, and joins with the Rohtás and Kharian ridges, and from thenceforth the range is one. These three spurs are entirely of miocene formation, save that in the centre of the Rohtás spur, a portion of the Devonian series appears, in which is situated the Tilla mountain; in a certain portion also of the ridges, where the Kharian and Rohtás spurs meet, in the Chambal hills, both Devonian and eocene strata appear.

* Settlement Report of Peshawur district, by Major James.

At first the range runs west-south-west and reaching its most southern point at Fatihpúr, turns north-west again to Kálábágh. From that place onward there is a continuation of the range to the north from the Chaunka and other hill series of Bunnoo and Kubat; to the south the range is continued under the name of the Chichalli hills, which run nearly parallel in a southerly direction to the west bank of the Indus, as far as Isakhail and the Kúram river, after which comes a fourth, continued in the Kafir Kot and Shaikh Budín hills, forming the west bank of the Indus (the fossils of which are exhibited in the series of Dr. Costello) and terminate in a junction with the offshoots of the Sulaimán range.

The structure of this range may now be roughly but pretty accurately described, by saying that it consists of a series of belts of different formations,—Devonian, carboniferous, oolite, eocene and miocene, ranged in tiers; the base of the hills being formed on one side of the range by the Devonian, and on the other by the miocene; the other strata, carboniferous, oolite, and eocene, are ranged between, in the order I have named them, in those parts of the hills in which the whole series are exposed to view.

Starting at Jalálpúr at the foot of the hills, and close to the river Jhilam, and following the range in a west-south-west direction, we find the lower portion of the range skirting the "thal" or flat desert that intervenes between the range and the river Jhilam, consisting of rocks of the Devonian period. The series is visible along the entire range from Jalálpúr to Kálábágh. Above this series comes the carboniferous, which however, does not run the whole length of the range as the other series do. Starting at Jalálpúr the carboniferous is not visible above the Devonian till we come to Núrpúr when it appears as a thin belt, and then on reaching the Khírí hill, an eminence 3,000 feet high, it widens out, and continues as far as the Vahi river and Músá Khail, where the hills break. The carboniferous continues again on the other side of the break, and not far from the Indus near Kálábágh. Then comes the eocene which continues all down the whole range, almost without intermission. From Jalálpúr as far as Núrpúr, owing to the non-appearance, as just mentioned, of the carboniferous, the eocene is above the Devonian; after Núrpúr, it is above the carboniferous and oolite.

The miocene strata form the base of the other (the north) side of the range beyond the eocene, and continue without intermission down the whole length of the range.

The oolite series only appears as a narrow belt above the carboniferous, and between it and the eocene, from Kálábágh to the Gamúndra hills, near to the fresh water lake that appears in the highest point of the carboniferous formation in the vicinity.

The distinguishing features of these strata are that the southern, the Permian and Devonian, are the salt bearing series; the central the limestone, the débris of which forms a fertile soil; and the northern, form the miocene sandhills.

The southern side is described by Dr. Fleming as presenting "a jagged angular outline produced by a succession of points running towards the plain, and separated by deep intervening strata. These points are formed by, and in many places formed of, masses of rock and débris, which, during the upheaval of the Salt range, and subsequently from atmospheric and other disturbing agencies, have been detached from a high escarpment, with the strata of which they have undoubtedly been at one time continuous."

The small streams which run down from the hills, with one or two exceptions only, are saline, and instead of fertilizing the plains at the base, convert them into a "thal," or desert, which produces in some places, a stunted jungle of the *Capparis aphylla*, &c., but has scarcely any grass or cultivation.

The limestone ridge above, at a height

varying from 2,000 feet and upwards, where it exists as table land, is cultivated and productive, and when it is broken into ridges, it is still interspersed with cultivated valleys. On the limestone portions, besides the cultivation, the light green *Dodonæa* flourishes, and also the *Adhatoda vasica*, together with the phulahi *(Acacia modesta)* and the kau *(Olea)*.

The northern district consists of low soft sandstone hills, devoid of cultivation, and abounding in the "fálsa" or *Grislea tomentosa*.

I now proceed to a brief geological description of the strata-series above enumerated, premising that the sketch is only intended to serve as a guide to the mineral collection, which, exhibited from the Jhilam and Shahpúr districts, and to some extent also from Bunnoo and Kuhat, represents the productions of the Salt range. The reader wishing for a minute account, should consult Dr. Fleming's Report published in No. XXII. of the *Selections from the Public Correspondence of the Punjab Government*, and Dr. Jameson's Memoirs in the *Asiatic Society's Journal of* 1843.

First, the Devonian series.*

The lowest beds are of a very red marl, which pass into argillaceous fissile beds of red clay, with red sandstone. Veins of gypsum traverse the marl, into the composition of which sulphate of lime largely enters; the red color is owing to peroxide of iron; thin beds of chert and siliceous sinter, with occasional patches of chalcedony also occur. In some places the marl is exhibited as a breccia, containing blocks of gypsum, salt, sandstone and limestone, which breccia was probably formed on the surface of the regular marl beds, at a period when the range underwent upheaval. It is remarkable about the marls, that they appear to have been burnt, and this is further established by the fact that in many places the gypsum they contain has been calcined into a plaster of Paris, and yet there is no indication of any plutonic rock throughout the range. The valuable products of the series, gypsum and salt, are mentioned under their appropiate heads in the collection.

This marl series is traceable from the beginning of the range in the Chambal ridge, and thence forward, sometimes disappearing for a considerable distance, and then re-appearing. From Jatána to Pind Dadán Khán the strata are uninterrupted then again go on to Musá Khail, and then again disappear, cropping out at Burakhail, and again at Kálábágh, where they are extensively developed. At Márí and Kálábágh, the marl has been subjected to violent disturbance, so that at the latter place, it might be supposed to be of tertiary formation, though its mineral character determines it to be of the same Devonian formation.

This marl then passes through beds like indurated clay to sandstone, which gradually loses its argillaceous character, and becomes lighter in color, and coarser, and sometimes passes into a grit. Bands of conglomerate also occur, containing moderate sized boulders of the older primitive rocks. The sandstone contains magnesia and carbonate of lime, and is not very good as a building stone, as it is hygrometric. No organic remains have been discovered in these series.

The red sandstone is succeeded by a series of greenish micaceous laminated sandstones, shales and calcareous beds, which in the eastern part of the range are developed, into an extensive deposit of sandstones ranging from dark gray to white, and weathering of a fawn color. The gray sandstones prove on analysis to be white siliceous sand held together with lime

* I subjoin for reference, Dr. Fleming's list of strata of the Salt range. *Selections from* the *Correspondence of the Punjab Government*. No. XXII. p. 265.

Primary.	Devonian.	*a.*	Red marl with gypsum and rock salt.
		b.	Lower red sandstone and grit with conglomerate.
		c.	Greenish micaceous sandstone and shales with gray dolomitic sandstone.
		d.	Upper red variegated sandstones, grits, conglomerates and clays.
	Carboniferous.	*a.*	Lower limestone, calcareous sandstone, and shales.
		b.	Gray sandstone and shales.
		c.	Upper limestone, sometimes magnesian.
Secondary.	Oolitic.	*a.*	Yellow iron-stained quartzose sandstones, grits and bituminous shales.
		b.	Cherty thin-bedded limestones with shales.
		c.	Green belemnite sandstones with shales.
Tertiary.	Eocene.		Brown calcareous sandstone, nummulite limestone, marls and alum shales with lignite.
	Micene?		Greenish sandstones, argillaceous grits, conglomerates, and red and green clays.
Post Tertiary.	Recent.		Alluvium.

and magnesia, sometimes the latter elements so predominate that the rock is almost a limestone; several samples of this stone occur in the collection: it is very durable. This formation forms the crest of mount Tila, and continues from Jalálpúr to Makrách. It is in rocks of this class that the crystals of sulphuret of lead, exhibited from Karungli hill, are produced. No organic remains are visible in these strata. The sandstones are succeeded by upper red sandstones, dark red shales, argillaceous sandstones, and a quantity of grits. Red oxide of iron and magnesia abound, and the sandstones are ripple marked. Towards the Indus these strata are represented by colored indurated clays.

In these beds also copper ore has been found in nodular concretions, from mere grains up to the size of a walnut; they are of green color, and are observed disseminated through the clays,; occasionally carbonate and silicate of copper appear. The ore is glance, an easily smelted and very rich ore: nothing like a vein has been traced. A pure specimen yielded on analysis in 100 parts:—

Copper, ...	75·830
Sulphuret of soda, ...	3·155
Sulphur, ...	21·000
Peroxide of iron and alumina, ..	·015
	100·000

This is stated by Dr. Fleming to be a favorable specimen, and he adds the average yield would be 12 to 20 per cent.

The carboniferous strata come next in order.

At Musá Khail, Dr. Fleming made a collection of shells, which were sent home, and there identified as belonging to the carboniferous period. When the strata rest on the Devonian, they are gray calcareous sandstones; above this they are compact and crystalline limestones, varying in color from light flesh color to nearly black. In these beds sometimes occur masses of hornstone almost like flint. The limestones are fossiliferous, abounding in encrinites and large brachiopodous mollusca; and in some places appear to be formed almost entirely of disjointed stems of encrinites. Towards the Indus and in the Chichalli hills, the strata assume a magnesian character, and become devoid of fossils; the change is observed in several places.

Above these come beds of fine-grained fissile micaceous sandstone and beds of bituminous shale. Then come the beds of upper sandstones, only occasionally developed, forming the summit of the Zamání hill. On the west bank of the Indus, in the Chichalli hills, the upper limestone is more extensively developed, and in the Kafir Kot hills, is represented by a brown bituminous sandstone, near which petroleum issues.

These carboniferous beds are all of salt water origin. The rocks of the series yield excellent building stones, and marbles, which take a fine polish. At Varcha the flesh-colored limestone could conveniently be quarried; and the black, near Kathá. The yellow argillaceous limestone of the upper limestone in the series, is said to be good as a lithographic printing stone.

Sulphuretted hydrogen springs issue in some parts, yielding sulphur deposits.

The fossils of the series are represented by *molluscs, crinoidæ, corals*, and *corallines*, Brachiopodous shells, *Producta, Orthis, Spirifer* and *Terebratula*, one or two *Gasteropoda*, and a *Cidaris*, have been obtained. In the upper part of the lower division of the series, the Brachiopoda give place to Cephalopoda, and *Bellerophon* and *Orthoceras* are represented; as also spiral univalves, *Cirrhus* and *Euomphalus*. These strata are remarkable for containing *Ceratites*, hitherto supposed to belong exclusively to the triassic group.

These rocks form a prominent feature in the range towards the Indus, and form the principal portion of the off-shoot Kafir Kot range, and it is probable that they occur in the Sulaimán range also. The series begins only at Núrpúr, and attains its greatest breadth about Kathá.

Secondary oolite.—Fissile argillaceous sandstones, grits, and a quartzose sandstone, often colored yellow with iron, represent the group; also beds of shale containing iron pyrites. Masses of lignite occur also. Above this the sandstones become calcareous, and pass into fine grained cherty limestones, of variable color, containing very few organic remains. No distinct oolite structure prevails, but the limestones of this series are unlike those of the carboniferous, they are hard and have a conchoidal fracture. The dark varieties on being bruised emit a smell of sulphuretted hydrogen.

Throughout the Chichalli range, a singular calcareous bed appears of a brown color, containing globules of a bright metallic lustre, having the appearance of particles of hypersthene rock.

Then follow yellow quartzose grits of the sandstones, containing *belemnites* and *ammonites* in great abundance: the sandstone contains also quantities of iron pyrites which decomposes. This series does not yield any building stones, but only stones fit for lime burning. The series is not much developed save above Kathá, where the carboniferous strata expand, and thence onward towards the Indus. It does not occur at all near the eastern part of the range. The Chichalli range also contains the same kind of rocks all along. It is probable also that they are represented in the Sulaimán range.

Iron pyrites decomposed into "kahi" occurs in shales of this series. "Kahi" is largely collected at Musá Khail. The lignite occurs only in insignificant portions, except at Kálábágh, where there is a considerable quantity; some of the coals have impressions of ferns, &c. Clay iron stone occurs in small beds among the shales. The fossils of this series, besides ammonites and belemnites, are *Gryphea*, *Plagiostoma*, and Saurian remains, chiefly teeth and bones.

Tertiary rocks.—These strata commence with bands of claystone, often ferruginous, and sometimes almost like pipeclay; resting on this is a greenish brown incoherent calcareous sandstone. At Kathá it gradually becomes more calcareous, and contains fossils—gasteropodous shells and nummulites. Westward to Musá Khail, the bed becomes arenaceous limestone, abounding in the fossils of the nummulite limestone series. Above this lie series of bituminous shales. These strata yield the alum shale, from which alum is made at Kálábágh. Iron pyrites and selenite crystals occur in the shales which are undergoing rapid decomposition; in some places, spontaneous combustion has set in. The shales above this become marly, and again nummulitic limestone occurs, and also a limestone which appears to have been formed by the strata breaking up on deposit, and then being re-agglomerated by the infiltration of calcareous mud.

Above the limestone are beds of an argillaceous character, then blue marls, and then more bituminous shales. Above these come beds of argillaceous limestone something like chalk; and above these are beds containing rows of flint, just like chalk flints. West of Pind Dadán Khán, the limestone generally forms the crest of the hills, appearing between that place and Kathá, and in the Chichalli range, as precipitous white cliffs, looking like chalk in the distance. The limestone is not suited for building stone, but is much used for lime burning: the boulders of it, which occur in abundance at the foot of the hills, are collected for the purpose. The minerals yielded by the beds are *alum*, *petroleum*, *sulphur*, and *coal*; all have received notice in their appropriate places.

The fossils characteristic of the series are, besides Foraminiferæ and nummulites, Gasteropoda of the genera, *Conus*, *Trochus*, *Oliva*, *Mitra*, *Voluta*, *Terebellum*, *Natica*, *Neritina*, &c.; some large bivalves also occur. Cephalopoda are scarce; but species of *Nautilus* occur. Of RADIATA—*Spatangus*, *Galerites*, and *Clypeaster* were found. A few sharks' teeth and bones represent the VERTEBRATA.

These strata occupy a much larger porti n of the range then any of the foregoing.

All along the eastern portion of the range, the eocene supervenes directly on the Devonian; after this the carboniferous come between. These strata occur considerably on the southern portions of the Sulaimán range. Nummulitic rocks of a different appearance however from these have been observed in the Hazara hills, and this limestone has also been found in Kashmír. The remarkable extension which these beds have all over the old world renders them full of interest. Much yet remains to be done in tracing their extent in North-western India; at present no doubt a large portion of hill territory where these series occur are as yet unexplored by any geologist.

Later Tertiary Rocks.—These are referred provisionally to the miocene group. The first of the series is a bed of conglomerate, consisting of small rounded boulders of limestone, similar to that of the eocene period just described: this passes into a series of soft greenish sandstones alternating with beds of conglomerate in which small boulders of plutonic and metamorphic rocks predominate. These bands are numerous at Kálábágh, where there are boulders of a black stone (melaphyre). The sandstones are calcareous, and contain also triturated quartz, hornblende, mica, and magnetic iron; at the surface they are soft, but lower down the beds assume considerable hardness.

Those strata are of great thickness; they form the whole of the northern slope of the range, and the three spurs described as joining the starting point of the range, belong entirely to this formation, save that in the Rhotás spur the Devonian strata appear. Beyond Jalálpúr, on the south slope of the range, no miocene strata appear at all during the whole series till we cross the Indus and come to the Chichalli hills.

It is not certain whether the strata are of marine or fresh water origin, but there are no marine remains any more than there are in the Thibet tertiaries. The hills between Rawalpindi and Báramulla pass, are referred by DR. FLEMING to this series; indeed, from the Báramulla pass to Urí on the Kashmír river, nothing but miocene strata occur, forming ranges often to 8,000 feet in height.

Gold in minute scales occurs in the formation, which has been described in its proper place.

In the sandstones and grits, bones and teeth occur, remains of large mammalia, generally fragmentary, and rubbed, as if transported from a distance. Portions of teeth of *Mastodon*, *Mammoth*, *Elephant*, horns of deer, and teeth of a species like the camel; some large *Saurian* teeth, and the Carapace of a Chelonian was found: the fossils are nowhere in great abundance. There is also much fossil wood silicified and of a brown color. Of molluscs, only species of *Unio* or *Anadonta* were found by DR. FLEMING.

It appears highly probable that these latter beds are the western extension of the Siwalik strata.

Above the tertiary strata are alluvial deposits of quite a recent formation; they are full of boulders and form beds of gravel. There are also belts of kankar and calcareous concrete. Over the surface of the nummulitic beds and miocene strata, travertin and calcareous tuffa have been formed, which are very valuable as sources of lime.

As to the general deposition of the hills, it would appear that the Devonian salt marl strata, judging from the ripple mark, were deposited in shallow water; that the lower carboniferous beds, judging from the Brachiopoda remains, were deposited in deep water. From this it is inferred that the Devonian strata first were sunk sufficiently low to admit of this deep water deposit on their surface; the carboniferous strata then must have rapidly increased in thickness, since the upper beds contain shallow water Cephalopoda. The sandstones of the middle carboniferous appear to be deposits of the surface of this sea, as marks of rain are seen in some of the beds; then it appears that the whole must have sunk again to a sufficient depth to allow another sea to form above them, full of the deep water Brachiopoda, which occur in the upper beds of the carboniferous series. Again these beds must have accumulated to the surface, for the oolitic grits and shales contains ferns and remains of coniferæ land produce. Again a subsidence appears to have followed, during which time the strata, now containing *Ammonites, Belemnites*, &c., were deposited; and the strata probable did not re-emerge till the close of the nummulitic formation. By a gradual and local deposition of calcareous matter along a particular line, similar to the manner in which coral reefs are formed, a sea barrier may have been raised inside which, in an inland fresh water sea, the miocene strata have probably been deposited."

When these strata were thus deposited, the beds rising and sinking at various period all the while, a grand upheaval of the whole appears to have formed the hills and valleys of the now Salt range, and to have completed the formation. It is impossible to notice the strata curved, broken, and displaced as they are in many places, and the complete submersion of strata at Kálábágh, and in the Chichalli range, without coming to the conclusion that the strata have been subject to violent upheaval; the burnt appearance of some of the lower marl strata, and the calcination of the included gypsum has been mentioned already, but there is nowhere any indication of an effusion of trap, or volcanic rock.

The foregoing is a geological sketch rather than a sketch of mineral products in an economic point of view. The various products that are valuable have been noticed along with the name of the specimen, but it is not easy to let the subject pass without a reflection on the extensive mineral wealth of the range; not only are building stones and marbles of great beauty produced in abundance, but we have a large variety of stones supplying lime to any amount; there is also gypsum for plaster of Paris, and various red earths and ochres occur, having value as coloring agents. Salt, coal, sulphur, petroleum, are all found; and many metals—copper, gold, lead, and iron; the latter as rich hematite, very abundant in some parts, to such an extent that the rocks containing it, prevent, by their attraction, the indications of the magnetic compass.

The Sulaimán Range.—It is unfortunate that our knowledge of the Sulaimán range is very confined. The wild and lawless habits of the tribes inhabiting them have hitherto prevented anything like a geological survey; little is known beyond what can be observed at the foot of the ranges bordering on our own territory, or inferred from considerations of similarity of structure with known ranges.

The upper portion of the Sulaimán range is unrepresented in the collection. The range forms the boundary of our territory on the west, and the length of the range is a little over 350 miles; of its geological structure there is not much known. Vigne states that, "it consists of recent formations, principally sandstones and secondary limestone," that the fossiliferous portions contain ammonites and marine remains. "The strata," he adds, "are much shattered and contorted, and often overlaid by shingle or débris." The loftiest peak in it is the Takht-i-Sulaimán, "Solomon's throne:" 11,000 feet. The Derájat division is watered by the streams which descend from this range.

The range itself is remarkably productive of vegetation and trees. The minerals representing it are from the districts of Dera Ghází Khán and Dera Ismail Khán.

The Dera Ismail collection includes iron ore, coal, and native mineral sulphur from the Sulaimán hills; also some limestones, clays, and red earths from the lower portions of the Wazírí country.

The Dera Ghází Khán mineral collection represents the portions of the range joining the Lagári, Mazári, and Gyandári hills, and the lower hills subordinate to the rest of the range. The minerals are coal, limestone, several clays, and red ochres, and a genuine fuller's earth; a sample of antimony ore is sent also, and alum shale, found in the Gyandári hills.

There are fossiliferous strata of the Lagári hills, a few fossils from which are sent. The Mazárí hills indicate their formation by the nummulites that are sent from these localities.

The Wazírí hills are represented in the Bannoo

collection, they exhibit much the same geological features. Sandstone appears from the Shaik Budín hills, and iron from the hills south-east of Bunnoo; the hills of the Khost valley beyond the frontier produce asbestos.

It is from this remarkable group of low hills in that corner, as it may be called, where the Salt range meets the Sulaimán range, that the best collection of fossils in the Exhibition came.

The Balút range is represented by fossil shells of genera—*Productus, Athyris, Orthis, Rhynconella Streptorhynchus, Lima, Natica;* together with *Anomia Lawrenciana, Spirifer, Pecten.*

There are also series of the limestones of this range and several shell limestones and coralline limestone, with species of *Ceriopora* and *Lithostroton irregulare;* and from Shaikh Budín there are *Belemnites, Cidaris, Pecten*, and other species of *Rhynconella, Terebratula, Lima*, &c.

The sandhills to the east of Shaikh Budín, abound in mammalian remains. There are bones and teeth of mammoths, and species of elephants and hippopotamus, several horns, tusks and teeth of herbivorous animals and rodents; and there is also a large fossil tree of monocotyledonous structure.

On the other side of the Punjab territory, there remain yet to be noticed that series of low hills, from which is derived the mineral wealth of Delhi, Gurgaon, and Hissar; they appear to be spurs and offshoots of the extremity of the Aravalli range. The principal hills are the Delhi hills, in the south-west of the district of the same name, and the Shekhawati hills, in Gurgaon, &c., and the Kalyána hill, at Dádri, which yields the flexible sandstone, and a gray marble, called Narnaul marble. It is among the hills in the Delhi district that the crystal series of Aurangpúr occur, and that a white clay supposed to be kaolin is produced. The range of Delhi appears to contain limestones—marble, and some sandstone strata—the sandstones are probably Vindhyan. In Gurgaon several clays—white, red and yellow—and mica occur; also hematite and ironstone, and also copper, both at Singhána and in Hissar. Ballabgarh yields white and red sandstones, and the mottled, red, and white, and blackish of the "new red" group.

The most marked hill ranges in the Gurgaon district appear to be first, the hills that rise on the boundaries of the district, in the extreme south of the Fírozpúr Iláka; these hills run almost due north, forming the west boundary of the Gurgaon district as far as the villages Fírozpúr or Noh. On reaching the confines of Noh the range turns off to the north-east, towards Sonah close to which town it passes. At some considerable distance beyond Sonah, it spreads out into three spurs, the eastern one running to Bhúnsí; the middle one along this spur, runs out into the Jharsah Iláka, on which are many scattered hills besides; and the third, or western spur, continues within in the Sonah Iláka, and ends a little beyond Kásun. The length of the greater range must be about 50 miles.

There is also a range of hilly tracts on the south, which rises in the Fírozpúr Iláka, like the range just described, but on the other side of the Iláka, it at first runs parallel to the first range but after sometime branches off to the east, and ends in the Hatín Iláka; the length of this range must be about 25 miles: it has some off-lying hills, particularly on the east side.

There is also an outlying hilly tract on the north, in the centre of which would be point of junction of the boundaries of the Sonah, Pakal and Jharsah Ilákas, but the principal part of it is within the Páli and Sonah Ilákas. The latter hilly tract expands beyond the Gurgaon district, forming the hilly tract on the north-west corner of Ballabgarh, from which place an offshoot in a north-westerly direction for some distance past Mahrouli and the Kuttab Minár; it then suddenly divides into two arms, one of which runs due south back again towards Jharsah of Gurgaon, and the other due north-east to near the city of Delhi. These are the only hills in the Delhi districts, the north-west portion contains no high tracts. On the Meerut side of the Jumna a long range of low hills runs along the banks of the Jumna, but that is beyond the boundaries of the territory with which we are concerned.

The hills must certainly be considered as the marked feature in the Gurgaon district. One range, from a glance at the map, will be perceived to traverse nearly its whole breadth during part of its course, passing through the pergunahs of Jharsah and Sonah, and for the remaining part forming the boundary to the west between the pergunahs of Noh and Fírozpúr and the territories of Alwar. A second rises near Peningwa of Púnahana, and running south forms to the east the boundaries between the pergunah of Fírozpúr and the territory of Bhurtpúr. These ranges, and the country in their vicinity, are possessed by the Meos, and popularly called the "Mewat hills," and to the nature of the country in which their fortune had thrown them may not improbably be traced the origin of the predatory habits which have been considered to distinguish this tribe. Again to the north we fall in with a shorter and smaller range of hills than those I have alluded to, dividing the pergunah of Páli from those of Sonah and Jharsah and terminating at Delhi on the Jumna. These hills and the country in their vicinity are principally occupied by the Gújars, a people similar in habit to the

Meos, and certainly at this date exhibiting far smaller signs of improvement.

"There are no other ranges of hills within this district. Detached hills are common, particularly in the pergunah of Rewarí, but none of considerable size or continuance. Here too, however, the country in the vicinity of those hills will generally be found to be occupied by Ranghurs, the worst tribe known in this territory.

"All these hills, whether the ranges or the detached portions are of insignificant height. I doubt whether any in the district will be found of an elevation of 500 feet above the level of the country at their base, and they yield nothing. The grazing on them, as far as I have had an opportunity of observing, would seem insufficient to support a few goats. There is no wood produced on any portion of them, and even the very stone of which they are occasionally composed, appears a useless material, either a quarry impossible to work or a sandstone possessing no durability.

"It may be marked that the western range of hills, which I have noticed, would seem rather to be the termination of the great table land of Rajputana, than any rising which can with precision be termed a hill or range of hills. At Sonah, mount the hill beyond that town, and you find yourself at once on the plains of Rajputana. In this view this range is to be distinguished from those of Pálí and Peningwa, the country on either side of which is pretty, and of the same level.

"I have not a sufficient acquaintance with geology to hazard a conjecture as to the formation of these hills. Certainly, however, in so far as a person unequal to form a scientific opinion may be justified in giving one at all, these hills (in Rewarí particularly) appear most of them to exhibit signs of volcanic origin, and even now, as I have heard stated on what seems to be good authority, symtoms are occasionally perceived which would seem to show an agency of the kind to be still at work."*

The geology of these hills, is as yet unstudied. Scattered notices of these are to be found in various papers. The "Gleaner in Science," vol. ii., 143, has a notice on the Geology of the Bhurtpúr district; and in the 3rd vol. of the same work, is a brief account of the ironworks of Firozpúr.

In the Asiatic Society's Journal, vi., 53, is also a notice of the geology near Delhi.

* Report on Delhi and Gurgaon, p. 5-7.

SUB-CLASS (C). SOILS.

It remains now to add to our brief survey of the hill regions of the Punjab, some account of the nature of the soil in the plains. Of the hill districts, we are in possession of information varying in amount and value, according as they have been surveyed or not. The hills of the Delhi, Gurgaon and Hissar districts, including the Mowatti hills, are hardly known or described at all; although from the Exhibition collection, it is evident that their metallic and other products are as valuable as they are interesting, including iron, copper, plumbago, sulphur, marble, mica, rock crystal, kaolin, slate, and many others. On the other side of the province, the Sulaimání hills are unknown, save from what can be observed on the lower slopes bordering on our own territory ,and what is inferred from a knowledge of the relation in which these ranges stand to other ranges, which we have been able to examine. The same may be said of all the network of hills north of the Salt range and Peshawur, Yusafzai, including the Wazíri hills and others, as far as the "Safaid Koh." Nor is it easy to extend our information till persons with the requisite geological knowledge are brought to the task. The officers of a district, however intelligent and willing, are generally unable to carry out surveys of this description; they will moreover be so constantly liable to error in describing the rocks and strata, and in referring them to any probable era of formation, as to render their observations necessarily of little value. This was to a great extent visible in the mineral collection of the late Exhibition, where a want of mineralogical and geological knowledge has caused limestones to be called sandstones, gypsum to be called soapstone, iron pyrites to be mistaken for gold ore, and has given rise to many other mistakes, which rendered the preparation of a correct Catalogue hopeless; save in the way in which it was actually effected, by going through the whole collection, and ascertaining, proximately at any rate, the nature of the specimens (by whatever name called), from the results yielded by the ordinary chemical tests, and by the blowpipe. In this way many a bright vision has been dispelled: the promised tin ore of Hazara proved to contain no trace of tin; the Lahore samples of a supposed native sulphide of zinc, yielded no indication of that metal; and several supposed copper ores and auriferous sands failed in a similar manner to evince any intention of producing the desired metals. Hence our knowledge of our geology is not likely to increase till we have scientific surveys of these hills; but considering the amount of mineral wealth that even an unscientific examination proves them to contain, it would be well worth while to examine them carefully. The hills of Gurgaon and Delhi would well repay a scientific survey, like that given the Salt range, by Drs. Fleming and Jameson.

Our sketch, therefore, of these hill regions was necessarily very imperfect, and serves rather as an indication of paths to be pursued and investigations to be conducted, than as a summary of results already obtained, or of facts known and recorded.

The consideration of the structure of the great plains of the Punjab is not beset with any such difficulties; the mineral products of the plains are few and their characteristics easy of recognition. The differences of the soil are determined by a chemical analysis,

and the main distinctions observable are the results of simple causes, to be described as we proceed. These attract the notice of the cultivators of the soil, who attach names to the varieties of land that occur, and which strike their attention as being more or less productive, as yielding to advantage only certain kinds of crops, as being sandy and barren, as requiring large irrigation, and the like. We shall of necessity resume the subject when we come to the Agricultural Section of the Exhibition, and many descriptive notices of the "bar" country,—of the desert tracks, and river-side plains which are omitted here, (as illustrating rather the cultivation than the geology of the localities,) will be found under that class.

The plains of the Punjab may be described as vast expanses of alluvial clay and loam, whose elementary constituents must once have been the same as now form the rocks of the huge ranges of mountains to the north. The principal constituent that produces a variety in the nature of soils, and one which is very important in the Punjab, is sand; in fact the main distinction of soils (apart, from that of their containing or not containing "kalr"—the efflorescent salt), is that the soil is sandy, as in many portions of districts it is, or that it is rich loam and clay. The sand is either washed down by rivers which flood their banks,* or else the streams change their course, leaving beds of sand behind, as is often the case in the Punjab; in some cases also sand is blown by winds from adjacent sandy or desert regions, or from these very deserted river courses, to districts where otherwise it would not be found. The influence of sand in the district of Hushyárpúr may be taken as an illustrative example. In this district the hills, being of sand formation, are constantly contributing to silt up the shallow beds of the torrents until the water overflows them, and finds a lower level. The sand is then drifted by the high winds that frequently prevail over the surface of the country, until, in course of ages, the tract for some distance from the hills, has obtained a high level, and to this is attributable the fact of the non-existence of kankar for metalling roads.

At Adampúr, and 20 miles from the foot of the hills, kankar is found on the surface: whereas it is found at Hushyárpúr only at the bottom of the wells, some 15 to 20 feet below the surface, after digging through sand, and sometimes deposits of loam and clay.

The alluvial plains thus constituted are intersected at intervals by the rivers of the Punjab. Every tract of country between two rivers forms a "doab," a tract which is always higher and more sterile towards the centre, and gradually becomes more fertile on either side, as the river is approached. The rivers usually overflow their banks sometimes to the extent of miles round during the seasons of heavy rain, and contract in the dry seasons till the slender stream is spanned by a bridge of a few boats, having dry beds of sand or mud on either side, which are then brought under cultivation. Such being the character of the rivers, changes of their course of greater or less extent are not unfrequent.

To take one instance, the Rávi at Lahore, which once flowed close to where the Múltán

* Some rivers are much more liable to be flooded to excess than others. The Markanda, in the Ambálla district, is a remarkable instance out of many; at one time of the year it is like an ocean; at another it will be a slender stream, hardly to be called a river. The Indus always contains a large body of water, but even this river is liable to become dammed up in the hills, whence it rises; the water then accumulates and bursting at length these bunds, come down with terrible force; once or twice these floods have occurred, giving only a few moments notice by a sound as of distant thunder, and then coming on with a sweep that spreads desolation for many miles. The rise of the Ravi, Chenáb, and other rivers, will be familiar to every one who has travelled in the Punjab.

The reader of Punjab experience, will remember how at some seasons he has crossed a river on a bridge of boats not a hundred yards long: while at others, he has scarcely been rowed across the same river in six hours, the water having risen and extended to the size of a small ocean. This rise will frequently take place in the course of a couple of days, sometimes in a few hours.

road runs (it carried away a portion of a beautiful ruin standing at the side of it), and then flowing on, passed close under the walls of Lahore,—has now so altered its course, that it cannot be seen even in the distance from the Múltán road, and it runs also nearly two miles distant from the city. Besides the rivers, the country is also fertilized by "nallahs," or water-courses, running into the country from the river beds. These are formed during the overflow of the main rivers; the water forces for itself a passage inland and accumulates in some place where the soil is soft, or some other peculiarity of the ground renders the excavation easy, and thus having once made a deep groove or channel, it remains there afterwards, drying up at the end farthest from the parent river, during the continuance of the hot season. Some of these nallahs, contain a very considerable body of water, and traverse whole districts; of this fact the Deg nallah, in the Lahore district, furnishes a good example.

In color the soils are generally of a drab or pale brown-gray; in some places they are darker from the presence of organic matter, and in the very poor and "rukh" lands soils are pale, whitish, or yellowish-gray. Sometimes these soils are reddened slightly by peroxide of iron.

The soil is mainly classified firstly, according to the presence or absence of river, nallah, or canal irrigation; being called "báráni" when dependent solely on rain; "cháhi" when irrigated by wells; "ábi" when irrigated by canals or nallahs; "sailábi" when its productiveness is dependent on periodical flood or overflow of water in the neighbourhood, ("sailab,") or when the land is of such a nature as to be under water, from the mere fall of rain in the wet season. The second classification is according to the nature of the soil, whether stiff clay, sandy loam, or full of sand; but the terms descriptive of these peculiarities also to a certain extent include the consideration of moisture also.

The following is a brief account of the principal varieties of soil, but the names vary in several districts; and others have peculiar names for varieties which are not recognized beyond the boundaries of the districts in which they occur.

The varieties of soil mentioned, depend on differences which indicate the degree of productiveness and the necessity for artificial irrigation, more than any real geological difference in composition of the soil, and hence a minute consideration of them, more properly belongs to the agricultural section.

I will take as a standard, an ordinary plain district, exhibiting a fair amount of alternation of stiff clayey, pure alluvial, mixed sandy loam and barren sandy tracts, as also a fair amount of variety of irrigation—river, nallah, well or rain—and after noticing the kinds of soils we find there, I will add a notice of such soils as are recognised in other districts of similar character, but different geographical position.

Let us take for instance the Gujranwalla district. The great sub-division of land, is into high and low land, called "útar" and "nétar," the high lands being out of the reach of rivers, &c.; the "nétar" lands being on the banks, or otherwise subject to their influence. The "nétar" lands are sub-divided into "bet" and "dhaya," that is sailába land, subject to periodical inundation from the river, and land not so subject, respectively.

The "netar" has a number of varieties, called bhángar, mera, des, rohi, &c.

Rohi is the finest natural soil, a stiff loam, which breaks up into large clods.

Doshâhi is the "dúmat" of Hindústán; a clayey soil, generally of good quality, manured by cattle being folded on it; when manured, it grows cotton, fine wheat, barley, joar, makai, melons, &c. Without manure produces the ordinary crops of barley, gojí, and pulses. It is common all over the district.

Mera, a mixture of clay and sand, the "rusli" of Hindústán, has many varieties; some very good and equal to the best "dosháhi."

Tibbah, nearly all sand, the "bhúr" of the provinces, worth very little, and only grows the inferior crops of moth, másh, &c.

Besides these, there is a class of land which receives irrigation from the drainage of the higher "bar" and other lands, this is called "chamb." In this class, a good rice producing land is often found, and is then called "chamb rohi."

New land on the river bank often covered with fine

alluvial soil, is called "bela."* Land that is highly manured being irrigated land, in the vicinity of villages, is called "goera," and in the Cis and Trans-Sutlej States "nyái."

High and somewhat sandy tracts in the centres of "doabs," and equidistant from river influence on both sides, are called "bár," almost universally.

These names will be found to exist very generally in the Upper States, or Punjab proper; the names baráni, &c., indicative of *irrigation*, are quite universal.

In the Cis-Sutlej States, the main divisions of the soil, to a certain extent corresponding to the nétar and útar, are the low lands, being called "khádar;" lands which have at one time been the beds of rivers, or have been flooded; and "bángar," high land, requiring irrigation by wells. These great divisions are sub-divided as "nyáin," loamy land, cultivated with manure and artificial irrigation; "rúsli," good loam; "dákar," a low lying stiff clay, productive of rice and gram; and "bhúr," an inferior land with a large proportion of sand. Land that is inundated is generally unproductive for want of drainage, is called "choil." As we approach Hindústán, the Hindústání names become more common, and the Punjabi ones less so. In some of the sandy districts, as might be expected, the names vary considerably. In the Gugaira district, for instance, where the soil is very bare, there is but little scope for all the varieties of inundated, irrigated, and other lands; if land is culturable at all it is fortunate, and there is but little variety to distinguish. The most generally recognised names of the descriptions of culturable soil are "gusrah," "sikand" and retlí." In the Settlement Records, the name "dákár," which is locally unknown, was introduced by the Hindústání ameens employed on the measurements. The equivalent term is "gusrah." "Retli," as its name implies, is land with an excess of sand, and "sikand" is a stiff clay soil, suited for rice; it is called in some parts "pakki chikni."

In those parts of the country where regular sandy tracts occur, such as Shahpúr, Jhung, Muzaffargarh, these tracts are called "thal," or desert.

Some districts do not appear to recognize any classification at all. In the Jhung district, the people, with the Settlement Officer, the late MR. MONCKTON, could only say that their land was full of sand, or their crops destroyed by "kalr;"† at present it appears that the distinction of nahri (canal watered) and baráni (rain watered) is adopted.

The mineral products of such alluvial plains are few in number.

The first to be mentioned is the "kalr," a salt efflorescence, which is observed in many places.* Sometimes it extends over large tracts of land, rendering them almost entirely unproductive; they are called "kalri zamin."

Some kinds of plants like the kalr soil, among these may be mentioned garden stocks and wall flowers, and other brassicaceous plants; and also tobacco is said to thrive.

The water of wells in such districts is always bad; it contains so much sulphate sometimes, as to be almost brackish to the taste. It also contains (as does all the well water of the plains examined) carbonate of soda, a circumstance which may serve to account for the production of the kalr. These waters, if left standing for a day or two become highly offensive to the smell and taste. DR. BROWN, the Chemical Examiner for the Punjab, has exhibited a nitrate of lime as a remedy for kalr lands, which would convert the sulphate into a nitrate, by mutual decomposition. An account of this nitrate of lime will be found subjoined to the notice of the exhibited specimen.

The kalr salt is not made use of save at Kálábágh under the name of jámsan, in the manufacture of alum; the use has already been described. Should however the kalr consist of *carbonate*; then, indeed, the soil is used by "dhobis" for washing, and is also melted into a crude glass.

The next product is kankar. This is a calcareous concrete, consisting of carbonate of lime in irregular kind of foliated pieces; it occurs in almost every district and is dug out of the soil; it is extensively employed as a road metalling material, from its great power of binding; some kinds of it are also burned and yield lime. The formation of kankar may be supposed to be constantly going on; that found at the surface of the soil is small and friable, but that dug out from below, after washing and shaking in a sieve to free it from adhering mud, is a hard serviceable material. Contractors and others hire land from the cultivators for a fixed period; they dig the kankar, and when they have exhausted the store, they level the land which is then cultivated once more: the same land will again yield kankar after a certain interval.

It was mentioned just now that many of the Punjab well waters contained carbonate of soda, hence it is possible that water containing carbonate of lime may percolate the alluvial soils, which contain of necessity sulphate of lime, so that the action of the carbonate

* Settlement Report Gujranwalla District.

† Jhung Settlement Report, p. 21.

* Of the effects of this, an account will be found in the notice which follows this section.

of soda and sulphate of lime on one another, results in the formation of kankar (carbonate of lime) while the sulphuric acid has attached itself to the soda, forming the efflorescence of sulphate of soda.

The last product to be mentioned is saltpetre, (nitrate of potash) which is found in several soils, and especially near old buildings, where it effloresces freely; the process of its manufacture has been described.

Sal ammoniac has also been noticed as produced in brick kilns.

Of the varieties of soil in the hills we have less information.

Taking the hill districts bordering on the Ambálla division as an example, we find in Kotaha in the Ambálla district* the land divided into "kuláhú," land watered by kúls (water-courses supplied from an artificial pond formed by damming up the hill streams), and "obar," which is the same as báráni, land dependent on rain for its irrigation.

Obar land is of two kinds, "todah" and "khil." Toda are those little hanging fields like steps rising one above another, and are built up at their lower edge with stones, and which are liable to destruction by being washed down when the rain is violent. If the land is good, it is called "awal kism;" if stony and bad, "dúyam kism." "Khíl" land is that which is broken up with the hoe on the steep slopes of the hills; it is too steep to be ploughed. These kinds of soil are observable through many hill districts.

In the Kangra valley, we meet (as might be expected) with new names; the locality is singular, as to its climate, soil, and means of irrigation.

The usual distinctions is as to whether the land yields one or two harvests in the year, *i. e.*, "ek faslí" or "do faslí." The soil consists essentially of disintegrated primary rocks, with a sub-soil of boulders, affording good drainage;* the principal varieties are dependent on the nature of the adjacent formation; one kind being sandy and light, near the marls of secondary formation; and the other, a reddish soil full of gravel stones, being the tertiary formation. The names of soils are:—"bílochí," which is the best soil. "Delanoor behauli," gives wheat and rice alternately; unirrigated land is called "utar," and irrigated land, "kalesí"— "har" and "basand" lands yield only one crop.

In Peshawur it should appear that the unirrigated land is termed "merah," and villages at the foot of the hills whose soil is watered by springs, are called "koh-i-dáman."

I now conclude this sketch of the soils of the Punjab with an analysis of soils from several localities. The specimens from which these analyses were made, are in the East Indian Museum of London; the analyses are on the authority of Dr. Forbes Watson.

* Wynyard's Report, p. 30.

* Kangra Settlement Report, p. 53.

Territory.	Locality.	Remarks.	Composition per cent.												
			Water at 212° F.	Water above 212°, or organic matter.	Silica, free or combined.	Alumina.	Peroxide of iron.	Carbonate of lime.	Sulphate of lime.	Lime in other forms.	Magnesia.	Potash.	Sodium as Chloride.	Soda in other forms.	Phosphoric acid.
PUNJAB.	Near Rawalpindi, Sind Sagur Doab, ...	Drab colored dense soil, ordinarily cultivated, ...	4·430	2·840	59·500	17·890	5·110	1·164	0·069	6·778	0·720	1·038	0·074	0·404	0·107
	Numbhal, Sind Sagur Doab,	Reddish drab distinctly calcareous, cultivated but not manured, ...	3·940	1·010	50·490	11·890	7·420	16·660	0·839	3·915	1·218	1·102	0·315	0 943	0·069
	Kot Isa Shah, in the Jach Doab, between the Jhilam and Chenáb, ...	Cultivated, but not manured, ...	1·750	2·410	66·640	12·620	6·310	9·810	trace	...	1·330	0·520	trace	0·213	0·043
	Lahore, between the Rávi and Sutlej, ...	A light drab colored impalpable soil, carefully irrigated and cultivated with rice, the best soil near Lahore,	3·930	0·930	63·800	12·660	10·000	4·000	0·041	1·033	1·910	1·029	0·036	0·722	0·132
	Ditto, ditto,	Light drab colored sub-soil, 5 feet below the surface of a rice field, yielding the last mentioned soil, ...	2·160	0·500	66·337	14·630	4·100	5·459	0·051	1·590	2·010	1·820	0·033	1·313	0·097
	Ditto, ditto,	Light drab colored sub-soil, 10 feet below the surface. Very good siliceous soil,	1·260	3·700	65·800	12·814	6·280	4·690	0·155	...	3·070	1·244	0·080	0·900	0·092
	Sirdarpúr in the Barí Doab, between the Rávi and Sutlej, ...	Cultivated soil, ...	3·930	0·930	63·800	12·660	10·000	4·000	0·041	1·033	1·910	1·029	0·036	0·722	0·132
	Múltán, Bari Doab, ...	Light drab sub-soil: 3 feet below surface,	1·090	1·370	68·670	14·150	6·340	3·182	0·090	0·661	0·590	2·130	0·078	1·232	0·109
	Naushera, in Bahawulpúr,	Stone colored calcareous sub-soil, 2 feet 9 inches below the surface, ...	2·120	4·080	57·900	15·000	3·500	9·620	0·452	3·130	2·300	0·830	0·262	1·000	0·140

NOTE ON THE SALINE EFFLORESCENCE ON CERTAIN SOILS, KNOWN AS "REH."

I.—Origin and formation of Reh.

The subject of the deterioration of land by the efflorescence of "Reh" or "Kalr" has formed the subject of a Pamphlet, No. XLII., of the Records of the Government of India, in the P. W. Department. As the original may not be easily asessible to many readers, I purpose to present a sketch of the correspondence which has passed on the subject, as well as to describe those practical conclusions which are to be drawn therefrom.

The deterioration of land was first observed, or at all events first attracted serious attention in the villages along the Western Jumna Canal, and its branches, about Delhi, Paniput, Rohtak, and Karnál. In 1857, Mr. Sherer, Joint Magistrate of Allygurh, went on deputation to examine the tracts of country deteriorated, and the picture presented by him of the suffering in some of the villages was truly deplorable. Out of 580 canal villages, 59 or nearly 10 per cent., had been injured in degrees ranging from severely to partially, 6 per cent. being severely injured. The maximum appeared to be reached in Paniput where 46 villages, or 19 per cent. were injured out of 242. Col. Baird Smith estimated the loss of Revenue for the villages spoken of in Mr. Sherer's Report (which does not include the Punjab proper) as Rs 25,000 per annum. The water of the canal was submitted to Sir W. B. O'Shaughnessy, who on analysis, found it to contain nothing prejudicial to growth of crops, nor was there anything in the sub-soil itself. Col. Baird Smith demonstrated that the evil arose from the fact that the canal was embanked, and high above the level of the country: the consequence was that the water percolating through the soil on either side of the canal, in obedience to the law of fluids, rose upwards to seek its own level: in so doing it passed through the sub-soil, formed the salt (which he conceived to be in the soil itself) and worked its way up to the surface; there the water evaporated and left the salt in the form of a white powdery efflorescence. Col. Baird Smith considered that this would go on as long as the action of the water continued; and recommended as the only permanent remedy, the re-alignment of a large portion of the canal, bringing it at a proper level along the natural watershed of the country. Heavy rains and drainage only effected a partial remedy for the evil. Col. Smith argued strongly that although the costs of the change of canal line would be great, yet it would save the immense loss entailed on the revenue by the destruction of cultivation.

It must not be supposed, however, that the injuries arising from Reh occur only in land near the Western Jumna Canal. The salt effloresces in several parts of the Punjab, where there are no canals at all; in these places it appears in land irrigated from wells where the water is very far from the surface. In all cases the salt appears as soon as the soil dries. It is previously held in solution, and on the water evaporating, forms a white powdery efflorescence on the surface. It is a peculiarity of all efflorescing salts that they rise to the surface: the reader will see an instance of a similar efflorescence in the account of the production of Borax from the Púga valley in Ladákh.

The views that have been entertained as to the formation of Reh are various; some have positively denied that there is anything in the canal water, and insist that the Reh exists ready in the soil, and is dissolved and brought up by the percolation of moisture. Others have held that although the salt does not exist *as such* in the soil, yet there may be minerals in the soil, which acted on by water, more or less charged with carbonic acid, decompose and result in the salts and in kankar, &c. Others again consider that the small amount of salts proved to exist in the canal water, may by gradual concentration form a dangerous amount of salt in the soil. Both the latter views are probably more or less correct. The ablest exponent of them has been Mr. Medlicott, Professor of Geology at Roorkee. Mr. Medlicott observes that from Dr. O'Shaughnessy's analysis, the water of the canal is generally pure: one sample however is noted as containing "$\frac{1}{5000}$ of solid matter, partly organic, partly saline; the salts being lime and soda." The sub-soil at 2 feet below is clear of salt, and the efflorescence is only at the surface.

Mr. Medlicott remarks, however, that a decimal per centage of saline matter in the water may by

evaporation, soon accumulate to 3 or 4 per cent. The great majority of places affected by Reh are low lands, which receive the drainage of the surrounding country or are subject to swamping from the canals having no sufficient drainage. The water is therefore not disposed of otherwise than by evaporation. In this way minute portions of salt accumulate and gradually form, in the course of years, a superficial product destructive to cultivation. The rate of evaporation is of course very high, and such lands as Reh most often appears in, besides the direct effects of irrigation with water containing a fixed decimal proportion of salt, also receive water running from other lands which may contain a great deal of salt.

"The evident facts of the case go to prove that the injurious accumulation of salt is the slow result of prolonged concentration, of which the essential concomitant is swamping."

"It is a direct inference that if swamping is prevented and the drainage provided for, Reh will not appear."

Mr. Medlicott considers that this formation by concentration of infinitesimal quantities is the chief source of Reh; but admits that in some places the Reh seems due to a "supply of the salts more or less concentrated at some depth below the surface, from which the Reh is derived by the change produced by the water in circulation near the surface."

Whatever truth there may be in these arguments, it is quite certain that gradual concentration of saline matters in the water cannot be the only source of Reh, since all over the Punjab, Reh may be found in fields watered only by wells, on high banks and uplands, and on desert tracks, which have no water whatever but rain. Dr. Anderson, of Glasgow, expresses his opinion (which is perhaps the most reasonable as well as the one most commonly received), that the *constituents* of the Reh itself exist in the soil, and that when water acts on these, a catalytic action is set up, resulting in the formation of the Reh salt. Dr. Brown, Chemical Examiner, follows this opinion, and is opposed to the concentration theory,—at any rate as a generally or frequently applicable one. Whether the formation of kankar (the concrete of carbonate lime) has anything to do with the formation of Reh, is not yet alsolutely determined; though from the frequent observations of beds of kankar underlying Reh lands, it is more than probable that kankar is one of the products which form in the process. Several observers in Oudh have put forth these views, though some deny it. Dr. Whishaw, of Faizabad, has expressed the probable action by a series of formulæ: it is to be observed that in the Reh observed by him, *carbonate* of soda, and not the sulphate, predominated: it would be easy by substitution to construct a formula for sulphate of soda.

$Ca\,O,\ CO_2 + CO_2$ .... { $Ca\,O, CO_2$, precipitated (carbonate of lime).
(Carbonate of lime acted on by carbonic acid in solution), { CO_2 } $Na\,O, CO_2$, carbonate of soda.)
$Na\,O,\ SO_3$ .... { $Na\,O$ }
(Silicate of lime). { $Si\,O_3$ precipitated (silica).

That the salts are formed by the action of water is certain: *perfectly* arid soil would not produce the "Reh." When the formation is complete, the salts are either dissolved by rain or melted in their water of crystallization by the sun's heat (which they are at 98°); and then on any reduction of temperature re-crystallization, in a network of small crystals through the pores of the soil ensues. By capillary attraction the crystallizing salts creep upwards to the surface, and there giving off their moisture, fall in a white powder. It is the capillary attraction that accounts for the efflorescence being so often seen up the sides of high banks: just in the same way, if a solution of salt is left to dry up of itself in a basin, the saline deposit seems to creep up the sides of the vessel.

It will be necessary in order to arrive at a definite conclusion as to the formation of Reh, to examine more carefully the circumstances under which it appears. In Oudh (where the soil is called *Oosar*), several officers report that kankar is always found underlying Reh, others saying it is not; but the observations in Oudh have not been yet exhaustive, and the subject can only be determined after a series of accurate scientific observations, and not only on general official reports.

II. Analysis of Reh: the uses of the Salt.

With regard to the chemistry of the subject, I may remark that the canal water, well water and soils affected, have been submitted to analysis by Mr. Medlicott, Professor of Geology at the Thomason College, and by Dr. Brown, Chemical Examiner of the Punjab.

In the first place as to the salt itself. It consists of sulphate of soda with a variable proportion of chloride of sodium (common salt). Mr. Medlicott, found in a sample from soil near the Western Jumna Canal, 76 per cent. sulphate of soda and 24 per cent. chloride of sodium: another sample gave 96 per cent. sulphate to 4 per cent. chloride. Dr. O'Shaughnessy gives a case in which the prevailing salt is carbonate of soda. Soils containing from 5 to 8 per cent. of the Reh appear to be unfit for cultivation.

In some of the instances given by Dr. O'Shaughnessy, the per centage is much higher; at Jagú, in Paníput, it was 20 per cent. and this consisted of abundance of carbonate of soda with sulphate, and choride of sodium and lime. At Júah, of Paníput, the

per centage is 22·80; but there is little or no carbonate or nitrate of soda.

DR. THOMAS ANDERSON, Professor of Chemistry at Glasgow, analyzed in 1863, a sample of Reh from the Western Jumna Canal lands; its constituents were as follows:—

Soluble in Water.	Water,	7·40
	Organic matter,	6·61
	Alumina,	2·52
	Oxide of Iron,	trace.
	Lime,	1·09
	Magnesia,	0·51
	Potash.	1·84
	Soda,	1·44
	Chloride of sodium,	10·41
	Sulphuric acid,	6·06
Soluble in Acids.	Peroxide of iron,	3·30
	Alumina,	1·95
	Lime,	1·84
	Magnesia,	0·98
	Phosphoric acid,	trace.
	Silica,	54·46
		100·41

The insoluble parts are the constituents of the soil itself, a portion of which was mixed with the efflorescence collected.

The specimens of Reh (probably from the Lahore division) examined by DR. BROWN, Chemical Examiner for the Punjab, gave materially the same results, with however different proportions as to the ingredients. They contained a large quantity of sulphate of soda, a small quantity of chloride of sodium, and a variable quantity of carbonate of soda. No soluble salts of lime or nitric acid were found, but some carbonate of lime and magnesia insoluble in water, and a small quantity of phosphate of lime.

The carbonate and sulphate of soda act deleteriously on plants in two ways: first, by rendering the water too saline to be readily taken up by the plants; and, secondly, it has the power of destroying and dissolving many organized substances. Moreover, these salts being efflorescent, they give off water to the air, leaving the ground hard, dry, and unfit for the growth of vegetation.

Some species of plants, however, appear to flourish in Reh soil. The "kikar" *(Acacia arabica)* thrives; the tobacco plant is cultivated, and I believe certain brassicaceous plants succeed. Among flowers, I have seen particularly fine growths of stocks on saline soil.

The analysis above given, exhibit the constituents of Reh itself after it has been formed and scraped up from the surface. The sub-soils of affected lands have been examined, and it is observed that the quantity of saline matter diminishes the lower we descend. At two feet below a surface containing 40 per cent. of Reh the sub-soil contained but 0·167 per cent. and at four feet only 0·144 per cent.

It has been confidently stated by several observers, that the Reh is in the soil itself, and is evolved by the action of water. COL. STRACHEY, R.E., in his memorandum insists especially on this. It cannot, however, be said that the Reh in its *formed state* as a mixed salt, exists all ready in the soil waiting for water to bring it out, since all the analysis of subsoils hitherto made contradict this. If the statement were strictly accurate, it is obvious that it could be immediately proved: we have nothing else to do than to examine the soil *before* the Reh appears on it to disclose the constituents which, when acted on by water, would produce the efflorescence. Also when the Reh has appeared on the surface, an examination of the sub-soil at various depths ought to show (on the hypothesis) a difference in its constituents, from what the soil on which Reh had not yet formed exhibits. I cannot help thinking that we still require more accurate information as to the soils; and that it would be highly advisable to have analysis made of soils at various depths from places where Reh is likely to, but has *not yet* appeared; and also of soils from similar depths, where the reh *has fully* appeared on the surface. It must be remembered that the analysis hitherto made of the Reh surface itself, do not give us any clue to the manner of its formation, but only tell us what the substance is when it is formed.

With regard to the uses of Reh, I may say that it is employed, when abounding in carbonate of soda, for washing, and for making soap; also a crude glass is made from it. Ordinary Reh is used to mix with tobacco; and is extremely valuable in alum manufactures (*see* under head Alum, page 84) where it is called "Jamsan." The earth yielding carbonate of soda is called Reha, in Oudh, and is like the sajji mitti of Bengal.* In order to make glass, the salt is scraped up and mixed with water in shallow round tanks a yard in diameter; more salt earth is added till the whole forms a kind of mud: this is left to the heat of the sun, and a white crust soon forms over the surface; the crust is removed, and a new tank formed out of the remainder: into this tank the crust first obtained is put and mixed with more reha earth. It is on the formation of the second crust that the soda is formed; it is taken off, heated to redness in crucibles to expel moisture, and is then melted into glass, as it already contains silica. Sajji is formed from this reha by filtration, to remove the silicious particles.

III. Analysis of Canal River & Well Waters.

Thus far I have described the salt itself and the

* General Sleeman's, Diary of a Journey through the Kingdom of Oudh, 1849-50.

soil below it. It will now be proper to present a brief notice of the analysis of canal and well water, as an important part of the whole subject.

Mr. Medlicott's analysis of the Ravi water shows the existence (omitting insoluble and other substances) of 2·5 grains of common salt per gallon, and sulphate of soda 1·12, or of Reh, 1·46, being $\frac{23}{1000000}$. The Ganges and Jumna waters showed a similar result.

The following Table of Mr. Medlicott's analysis will give a very good idea of the soluble ingredients of the water, the numbers exhibit the results from 10,000 parts of water.

Locality.	Time of collecting the water.	Carbonate of lime.	Sulphates.	Chlorides.
Ganges, at Hardwár.	13th June, 1861.	0·4731	0·10293	0·08539
Ganges Canal, Roorkee.	22nd May, 1861.	0·57	0·1747	0·0357
Ganges Canal, Roorkee.	4th July, 1861.	(?)0·57	0·12507	0·00232
Jumna, at Faizabad.	18th June, 1861.	0·1600	0·2428	0·0174
Eastern Jumna Canal, 96th mile.	18th June, 1861.	0·4285	0·0914	0 1500
Ravi, at Madhopúr.	Collected in bottles on the 1st and 18th Sept.; 3rd and 15th Oct.; 15th Nov.; 1st and 15th Dec.	0·4514	0·2042	0·0285
Ravi, at Madhopúr.	Do. do. do. 15th Jany.; 1st and 15th Feb.; 15th March; and 15th April.	(?)0·4514	0 4325	0·0348
Barí Doab Canal, at Nyázbeg.	5th July, 1861.	0·4357	0·14244	0·01832
Thames at Twickenham.		1·97	0·38	0·25

The detail of the analysis of one specimen may be given as an example: viz.; that of Nyázbeg (Lahore branch, Barí Doab Canal.)

Silica,	·0114
Carbonate of lime,	·3700
Carbonate of magnesia,	·0657
Chloride,	·0113
Sulphuric acid,	·0801
Lime,	·0368
Magnesia,	trace.
Soda,	·0310

With regard to the possibility of the concentration of the minute quantities of salt found in the waters, Mr. Medlicott's estimate is as follows:—It is known that a soil containing 30 parts of sulphuric acid to 1,000 of soil, produces barren Reh land. 30 parts of sulphuric acid in 1,000,000 of water, by weight, may be taken as the greatest proportion contained in the canal water. Taking 2 as the specific gravity of sulphuric acid, it would require an evaporation of 5,000 inches deep of water, to convert 10 inches cube of soil into Reh land. Assuming the annual amount of evaporation to be 10 feet or 120 inches (Mr. Medlicott adds that this is not high, since Maury gives 15 feet as the amount in tropical seas, where the atmosphere is but little below the point of saturation, and not dry and arid as in the plains of the Punjab), we should then get rid of the 5,000 inches in 40 years. This period would be in fact much reduced by the contributions to the saline formation from drainage waters already charged with salt.

Dr. Anderson of Glasgow, reasoning from Mr. Medlicott's original analysis, which gives 7·14 grains of soluble matter per gallon of water, (about half being alkaline salts,) observes that taking the

whole 7·14 as Reh, still the result would be only 1 lb. per 1,000 gallons. He says, "if we suppose the soil to be covered with water a foot deep, and the whole of it to be evaporated, it would deposit on an acre of land about 128 lbs., of alkaline salts (a little more than 1 cwt.), and reckoning the soil at 10 inches deep, it would weigh per acre more than 1,000 tons. The alkaline salts thus added to the soil would amount to $\frac{1}{20000}$ of its weight, a quantity which would not be perceptible." It must be remembered in connection with this statement, that no allowance is made for the long continued swamping during a series of years, in cases where the water comes up on to the land, and cannot get off except by evaporation, leaving all its salt behind.

IV. Remedial measures.

It now only remains to notice briefly the remedial measures which can be employed for restoring Reh lands.

Where the Reh first attracted attention, namely, along the Western Jumna Canal, Col. Baird Smith was of opinion that the great remedy would be to re-align the canal along the natural water-shed of the country, and at the ordinary level, in lieu of the present high embanked level; this he accurately reasoned, would prevent the percolation of water, and the swamping that resulted from it. An opinion has rather widely been held of late, that canals should not only be at the level of the ordinary water-shed, but should actually be below it, even to a depth requiring artificial means of raising the water for irrigation purposes. This is not the place to discuss the wisdom of such an opinion, but it may be suggested that as far as experience goes, lands near canals, like the old Hasli, in the Lahore district, constructed at, but not below, the ordinary level of the water-shed, are usually found to be free from Reh efflorescence. It is admitted by the advocates of re-alignment, that drainage is to a certain extent a palliative and a cure.

Dr. O'Shaughnessy and Mr. Medlicott, both maintain that drainage varying in its plan according to circumstances, is the really efficient cure. Land affected with Reh, may be well washed, so to speak, by irrigation water, which will, if there is efficient drainage, soon run-off, carrying with it in solution the deleterious salts. In other cases the drainage being complete, the swamping which causes the concentration of Reh would be obviated.

With regard to the actual practice of the agriculturlist in dealing with Reh land, it may be observed, that in many places drainage has been turned into good effect. If the Reh land is not very heavily impregnated, the natives give it constant ploughing, free watering and manure, and this generally renders the land productive, at least of second-rate crops. Generally speaking the farmers assert that fully impregnated Reh land is incurable and valueless. In gardens and small plots, it has been found useful to dig out the soil to the depth of 2 feet or so entirely, and put in fresh.

Attention has been much directed to the discovery of some cheap manure, or chemical substance capable of being easily, produced in large quantities, which would neutralize the Reh.* His Highness the Rajah of Kapurthalla, offered a prize of Rs. 200, for the discovery of a remedy of this nature, but no success has been hitherto obtained. The nearest approach has been made by Dr. Brown, Chemical Examiner for the Punjab, who has demonstrated that nitrate of lime would succeed. Whether this can be made conveniently and cheaply, remains yet to be seen.

In the Lahore division the agriculturists make use of some natural salt efflorescences to correct the Reh. I should remark that every kind of efflorescence, be it carbonate, sulphate, nitrate, or chloride, is called by the general name of "kallar," a circumstance which causes no little confusion in considering the varieties of these salts. In the account of the manufacture of saltpetre, previously given, it will be seen that the terms "kalr" and "shor" are used variously for the crude material yielding nitre. In a very interesting paper by Mr. Gardener, part of which is there quoted, the writer actually raised a question about the manufacture of common salt from saltpetre earth, denying that it was ever done and saying that salt is educed from "kalr." The fact is that *both* the nitrous earth and the Reh having a preponderance of chloride (which is what the "lúngars" of old used to make alimentary salt from) are called kalr. Common salt can however be obtained from both.

But to return to the subject. The Lahore people recognize three kinds of "kalr;" whereof the first is a very good remedy for Reh; the second, slightly so; and the third, is useless, and indeed deleterious. The first is called "chikna kalr." It is known by the damp brown appearance of the soil it comes up in; the second soil is called "kalr," without any qualifying epithet, and the third, "shora kalr." Dr. Brown found the *chikna kalr* to contain nitric acid and lime in a soluble form as nitrate of lime; it also contains sulphate of lime, probably some chloride of calcium,

* A plan has been suggested, which however, is perfectly fallaceous, for covering the affected land with common lime. I have seen a paper setting forth this idea. Not only were the the costs of the lime, labor, &c., totally miscalculated, but it is impossible that lime should have any effect in converting the sulphate of soda and cloride of sodium into substances beneficial, or at least not deleterious to vegetation.

chlorides of potassium and sodium, and sulphates of potash and soda. Besides these there is a little phosphate of lime and sesqui-oxide of iron with magnesia and carbonate of lime. The second sort of kalr has a similar composition, but contains less of the nitrate of lime. The third kind, the "shora kalr," differs in different specimens. DR. BROWN found some few to contain a little nitric acid and lime, but the majority none whatever. It contained sulphate of soda and potash, chloride of sodium, and sometimes carbonate of soda. This kind is probably Reh itself mixed with earth. "Shora," means saltpetre, but also salt merely (as "daryá shor," the sea, "the salt river.") The term *Reh* is not commonly used in the Punjab, but "kalr."

DR. BROWN describes the action of the nitrate of lime (from which the remedial agents derive their value) as follows :—" When the deleterious sulphates and carbonates are mixed with any soluble salt of lime, as the nitrate of lime, decomposition occurs and nitrate of soda is formed while carbonate and sulphate of lime are also produced. Carbonate of lime is insoluable in pure water and has no power of injuring plants, while nitrate of soda and sulphate of lime are beneficial in supplying them with nitrogen, the former by the direct decomposition of its acid, and the latter by absorbing ammonia from the air." Nitrate of soda and nitrate of lime are both deliquescent and keep the ground moist.

Nitrate of lime is formed wherever organic matter decomposes in contact with carbonate of lime. Hence it is often found in old burial grounds, old walls (the mortar of which contains both lime and organic matter), and near cattle sheds. The crude nitre earth, "shora," contains frequently a proportion of lime, which is converted into nitrate of potash by filtering through wood ashes.

Nitrate of lime might be made by treating a mixture of kankar and water, with the impure but cheap nitric acid, made by distilling nitre and "kahi" (sulphate of iron earth) together.

The nitrate can also be obtained by mixing animal manure with chalk or lime in large heaps exposed to air but sheltered from the rain. The nitrates effloresce and are removed. In Europe it takes 2 or 3 years to get out all the nitrate from the heaps.

DR. BROWN has suggested the preparation of such beds (nitriers artificelles*) at a safe distance from cantonments, where they could easily be supplied with manure from the barracks. In this way a large quantity of nitrate of lime would be formed, available for trying experiments, as to the actual effect on the Reh land *in situ.*

* In Europe these artificial nitre beds are usually constructed with a view to obtain nitrate of potash ; for this purpose the ashes of plants are mixed with the heaps ; these convert the nitrate of lime into nitrate of potash. In the country where nitre is abundant, the ashes would be omitted, the desired product being the nitrate of lime.

CLASS II. PRODUCTS OF THE ANIMAL KINGDOM.

Division I.—Animal Substances used as Food.

The products of the Animal Kingdom, excepting the silk and wool departments, are by no means numerously represented.

This, however, is hardly to be wondered at, when we consider the present state of knowledge and civilization attained in the province. The mineral products of the soil, whether utilized or not, are still before every ones eyes in the districts where they occur, but it is not so in the Animal Kingdom. The most valuable products are seldom discovered at once, and it is only when the manufacturer begins to investigate the qualities of a substance, that he discovers the use first of one part, and then of another. Take the case of bone—there was no sample, either in the raw or manufactured departments, of the Exhibition, showing that the substance is even utilized. The proportion of the population that consumes flesh is probably less in this country than in Europe, but still the number of animals killed must be large, and the bones from this source alone form a very considerable produce. Now what is the case in Europe;—not a bone need ever be thrown aside. The finer kinds are cut into handles, buttons, and a thousand other articles: the chips and shavings that result from the manufacture are converted into size or gelatine, sometimes they are burnt for bone ashes or charred to form the bone-black and bone-brown, used as artists' colors; the coarser bones are readily used by the soap boiler, as yielding from their pores and medullary canals, a quantity of fat. When the fat is boiled out, there is a large yield of gelatine, and when that is removed, phosphate of lime remains. The phosphate of lime forms a most excellant manure, and therefore is valuable as it is; otherwise it is treated with sulphuric acid, which takes up the lime, and the phosphoric acid, being mixed in a retort with charcoal, gives phosphorous by distillation. Ammoniacal salts are also distilled from bones; and finally the bone burnt in a close furnace yields an animal charcoal, much valued in making water filters, and in the processes of sugar refining, for which later purpose it is purchased as high as £16 and £17 a ton! This list of the uses of bone is by no means exhaustive, it only shows how one use is learnt often in the act of bringing into operation another; and how, until civilization and knowledge advance we cannot expect to find many specimens in our Economic Animal Kingdom.

In the food department we have little to notice, beyond a few samples of hard cheese from Peshawur and Kashmír. Honey is not included among animal products, because it is most highly probable, that the sweet substance or nectar from the flowers does not undergo any chemical change in the body of the bee, but is merely conveyed and collected by the insect, and is therefore best included in the class of vegetable saccharine products.

The preparation of dried or smoked meats, fish, or other forms of preserved animal nutri-

ment, is not at all consonant with the habits and customs of the people, who indeed, have no occasion for such articles: consequently, the class is totally unrepresented, save by a few samples of "ghí," or clarified butter.

Of animal substances used in manufactures, horn is found to be sparingly used for drinking cups; and fancy articles are occasionally met with, such as walking sticks formed of thin tubes of iron covered with pieces of black horn neatly joined. There were also exhibited (simply as trophies of the chase) some nice specimens of stags' horns, ibex horns, rams' horns, and antelopes horns.

Animal fats and wax are tolerably well represented: they are however so much in demand, because the majority of native soaps are made from vegetable oil; and with natives, oil lamps almost universally take the place of candles.

The Wool and Silk departments are well represented, and no further mention of this series is necessary till we come to the collections themselves. The art of leather dressing is abundantly practised. The number of barks and other substances suitable for tanning is great, and these substances are for the most part of wide distribution throughout the districts of the province; but the tanning is a rude process, and a thick hard leather is the result; the finer skins, such as kid and Chamois leather appear unknown as indigenous manufactures. The best leathers are made at Peshawur, or brought from Kábul, where the process of communicating a fine turquoise blue to leather is successfully practised in a kind of imitation Morocco leather. Russian leather finds its way to Peshawur, through the Kandahar and Balkh merchants.

Núrpúr, in the Kangra district, is celebrated for its red leather, called "lákhí." The Kangra district is also famous for a soft leather which is made into the pyjama, or trousers, worn by the hill people in the neighbourhood. At Kangra also, the art of dressing the skins of wild animals of the chase is most dexterously practised. Leopard and tiger skins may be obtained thoroughly tanned, and yet having all the hair and markings perfectly preserved on the upper surface.

586.—[4042]. Cheese, value two seers per rupee. Peshawur. Local Exhibition Committee.

Peshawur.

587.—[4043]. Cheese, called Kúrút; price, three seers per rupee. Local Exhibition Committee.

588 —[4044]. Cheese, called "panír Kábli;" price, two seers per rupee. Kábul. Local Exhibition Committee.

589.—[4039]. "Ghí," clarified butter. Local Exhibition Committee.

Gujranwalla.

This is exported in very large quantities from the jungle tracts of the "Bar" to the cities of Lahore and Amritsar. The amount exported annually from this district cannot be worth less than a lakh of Rs. When the cattle are sent out into the Bar to graze, each large herd is accompanied by the agent of some shopkeeper or other: he advances money to the graziers, who in return let him have, every third or fourth day, the butter produced from the milk of their herds. This butter he manufactures into ghi, and sends off on mules or carts to the neighbouring large markets. This is a very remunerative trade, as may be imagined from the fact of traders being induced to advance money to graziers to ensure the product of their flocks. The ghi is generally sold at 25 per cent. above the cost of the butter.*

The cattle, whose milk is intended to yield ghí are carefully fed. Col. Clarke gives the following account of the method of feeding cattle in Gujranwalla.

Milch buffaloes are fed with "mala patra," or the dried and bruised leaves of the wild *bér*, which much increases the quantity of ghi; green wheat and mustard, and maize, green with the ears on, and "joar,"

* Settlement Report of Gujranwalla.

also increase the quantity of milk. Cows that have lately calved, and whose milk is deficient, get milk mixed with goor (molasses); and also wheat and barley made by boiling into a kind of caudle, called *kunji.**

Ghí is much produced in the Punjab, and forms an important article of export along with rice and sugar: it is of universal consumption among natives.

In the Hazárá district there is, or was, a regular trade with ghí which was taken by traders in exchange for the salt they supplied to the Kashmír merchants.

590.—[4040]. Ghí, from Shahpúr, the produce of "the Bar." The Deputy Commissioner.

* Punjab Selections, II. 29.

Division II.—Substances used in Medicine.

A series was exhibited, prepared by Har-sukh Rah.

591.—[ ]. "Reg mahi," a small mottled lizard, (*Lacerta scincus*, Linn.,) from 6 to 8 inches in length, found in the sands of Sindh and occasionally in dry tracts of the Múltán division.

This animal used to be formerly in the Materia Medica of Europe as a restorative, stimulant, and antisyphilitic; some modern Physicians have, however, justified the use of these animals.*

592.—[ ] "Mayá shutr 'Arabi." Rennet from stomach of camel.

The genuine article is brought from Arabia, and sells at a high price; the value of the quantity exhibited, about 4 oz., is Rs. 8.

593.—[ ]. "Jundi-be-dastar." Two samples, first and second quality.

This is the dried *castoreum*, the matter contained within two glands of the beaver, affixed near the organ of generation in both sexes. These glands are sometimes erroneously said to be the testicles, from which they are quite distinct.

"The glands," writes Moquin Tandon, "consist of two oval pyreform sacs of unequal size which open into the preputial groove by two large orifices. Those of the adult animal are at least 3 inches in length, sometimes 5. Those of the female are somewhat less developed. In the living animal the castoreum is an almost fluid unctuous substance of a strong penetrating and even fœtid odour; when dried the sacs have a dark-brown color, and wrinkled appearance. Both American and Russian castoreum are known to commerce.

"Castoreum contains a peculiar substance, termed castorine, a volatile oil, salicine, carbonic acid, benzoic acid, albumen, fatty matter, mucus, carbonate of ammonia, and salts of soda and potash. In native medicine castoreum is supposed to affect especially the uterus, and is given also in hysteria and apoplexy; and it was formerly used in European practice. 'Tincture castoric' is still in the Pharmacopœia, but is not of much efficacy or value."

* Moquin Tandon, Medical Zoology.

594.—[ ]. "Kharátín-khushk," dried earth worms.

Collected in the rains and dried.

595.—[ ]. "Mahi rubián." Dried shrimps, from the coast of Sindh.

596.—[2522]. "Mahi rubiáň ká kism." Not known. Brought from the Sea Coast.

The sample is not a shrimp as the first is; in appearance consists of dried up pieces, having a gray color.

597.—[ ]. "Kirmdáná." Cochineal. Imported from Bombay.

Cochineal is employed in European medicine to yield the *Syrupus cocci*, but only as a coloring agent with other tinctures, &c. (*See* Lakh, under Subclass A).

598.—[ ]. "Nákhún" are shells.

599.—[ ]. "Bhír buti." An insect of a beautiful scarlet color, resembling a piece of scarlet velvet.

Collected during the rains. They yield an oil, and have use similar to the cantharis, as a blister and irritant.

600.—[ ]. "Kekra," are the carapace shells of crabs.

601.—[ ]. "Samundar khág," (sea foam).

The dorsal plate of sepia, or cuttle-fish, and used as an absorbent and anti-acid; it is now in Europe only valued as a tooth-powder and in the arts. The bone contains 80 parts of carbonate of lime, according to the analysis of Dr. John, and the soft part 85.

602.—[ ]. "Fádániya," are intestinal calculi, consisting of phosphate of lime, &c.

They occur in the intestines of various animals; and were in former days highly esteemed in medicine, under the name of bezoar stone. The genuine article was of an olive green color, and was extracted from a goat's stomach. Persia was a celebrated locality.

603.—[ ]. "Mom," uncleaned wax, from the hills.

604.—[ ]. "Sang-i-marján," coral.

Supposed to be a tonic. The old practitioners of Europe had the same idea in former days; they administered it in the form of a bolus, electuary or powder, or as a draft and tincture, and they made use of a magistery, a precipitate of coral. Lémery considered it adapted to *renovate* the *heart*.*

There is a sample of a "Kushta sang-i-marján," from Sirmúr, a pink powder, which is not coral, for it does not effervesce with acid.

* Moquin Tandon, Elements of Medical Zoology, p. 89

605.—[ ]. "Mah-ul-luhm," "essence of flesh."
Peshawur.

"Mah-ul-luhm" is thus prepared:—The flesh of a young lamb being cleared of bones, fats, sinews, &c., is boiled in a moderate quantity of water, until only one-third of the water remains. This is strained off and such quantity of condiments or aromatic drugs added as may be deemed advisable. From this an essence is distilled, which is prescribed by native hakeems as a tonic. There are other various ways of preparing this substance, but the method just related is the most common.

Division III.—Substances used in Manufactures.

SUB-CLASS (A.) SKINS, FEATHERS, LEATHERS, HIDES.

A collection of skins and a few stuffed birds were sent to the Exhibiton, but principally for ornament as trophies of the chase. The list represents only a few of the Himalayan animals.

A few skins are made use of and exported. The otter's skin is prized for making caps; and also postíns, or fur jackets.

The skins exhibited are principally from the hills around Kangra and Simla; a few of them are imported, such as the sable from Russia, and the Karakuli lambskins of Bukhárá;* these are used only sparingly in this country, the season seldom requiring them.

SKINS.

Simla.

606.—[5534]. Skin of chital, or spotted deer. Sirmúr. Raja of Sirmur.

Tigers skin. Do.

607.—[5540]. Two foxes skins. Capt. G. Pengree.

Skin of Ibex.

Do. Barral. (Himalayan sheep).

Do. Thár. (Himalayan goat).

Do. Kakar. (Barking deer).

Kangra.

608.—[5551]. Leopard's skin, "mirgh." Kangra hills. Kangra Committee.

609.—[5552]. Bear's skin, "bhálú." Do.

610.—[5553]. Flying squirrel, "saiń." Do.

611.—[5554]. Skin of muskdeer, "bína." Do.

612.—[ ]. Armadillo, "salgar." from Tírah Sujánpúr.

613.—[ ]. Otter skin, "'udh."

614.—[5572]. Fox's skin, "lomri," Spiti. Kangra Committee.

615.—[ ]. Stuffed "gural," chamois. Kúlú. Kangra Committee.

616.—[ ]. Stuffed "karth." Kúlú. Kangra Committee.

617.—[ ]. Wild cat, "ban billi." Kúlú. Kangra Committee.

618.—[ ]. Pole cat, stuffed. Mr. Prince, Kangra.

619.—[ ] Tiger cat, stuffed. Mr. Prince, Kangra.

620.—[ ] Porcupine, "seh," or "sáhí." Kúlú. Kangra Committee.

Muzaffargarh.

621.—[5654]. Tiger skin. Captain Hawes.

Killed in the Muzaffargarh district.

622.—[5665]. Hogdeer's skin, "párhá." (*Cervus porcinus*). Captain Hawes.

Bunnoo.

623.—[5660]. Otter's skin, "saglahú," "sag-i-abi," (lit. "water dog") from the Indus. Deputy Commissioner of Bunnoo.

These otters are occasionally found, and the skins used for fur caps, postíns, &c., &c.

* Called so from Karakul, a province 20 cos south of Bukhárá; as much as 10 lacs worth of these lambskins with the hair on, are exported to Persia, Tartary, Kábul, and India; other districts of Bukhárá produce them, but all are called Karakuli. Davies' Report, Appendix XXII.

624.—[5629]. Large white fur. Peshawur. Bukhárá? LAHORE MUSEUM.

This is in all probability an imported Russian skin.

625.—[5673]. Sable, "sanjáb." Russia. ATMA SINGH.

626.—[5679]. Skin of ibex. "Kel." Hazara. Kághán. DEPUTY COMMISSIONER.

627.—[5680]. Skin of large rat. Kághán. DEPUTY COMMISSIONER.

628.—[ ]. Stuffed black buck. Gugaira. TEHSILDAR OF GUGAIRA.

Stuffed foxes. TEHSILDAR OF HARIPUR.

Weasel, "niyal."

Hare, "khargosh."

Deer skins.

FEATHERS.

These are very little made use of in the Punjab; the down is never used for stuffing pillows and beds as at home, nor are feathers ever used as ornaments, save that one kind of bird, the "onkár," furnishes its narrow black wing feathers to make what are called "kalgi," that is plumes for the top of the "khod," or helmet; these consist of a number of the narrow tapering black feathers stuck upright in a ring into a holder, something in the way of the feathers of a shuttle-cock. The holder is covered with gold thread, and sometimes has pearls sewn on to it. These plumes have a very elegant appearance; they stand about 6 or 8 inches above the helmet. The feathers of the "obára" (*Houbara macqueenii*) are similarly used.

The collection contains a series of stuffed birds from the hills, showing the "múnál," or hill pheasant, the snow pheasant, one species of partridge, the "chakor," and others, which are not made any use of.*

The only application to use of birds' feathers appear in the Kashmír collection, where there are warm jackets made up of the skins of a kind of bird [No. 7728], apparently a water-fowl.

629.—[5671]. Feathers (Persia?) Peshawur. LOCAL EXHIBITION COMMITTEE.

"Pari-go," worth Rs. 3 a seer.

630.—[5678]. Skin of the golden pheasant (*Thaumalea picta*) Khágán. Hazara. DEPUTY COMMISSIONER.

631.—[7728]. Warm coat made of the skins of water-fowl. Kashmir.

LEATHER AND HIDES.

The leathers that are met with in the Punjab are either of local manufacture, European, or have found their way from Peshawur and the North-West Frontier and Russia. European leather is seldom seen, except in the saddlers and bootmakers, who make European articles. Russian leather occasionally comes to Peshawur, and is called "balghár."

There is a kind of leather having a metallic lustre, and called "kimsana," imported also from the north-west; and a beautiful leather, used in the manufacture of the bright blue green shoes from Kashmir and Peshawur, which is called "kimakht." This is not made

* The following birds, stuffed, were exhibited by MR. PRINCE of Kangra, from the hills about Kangra.

A pair of the Argus pheasant (*Ceriornis melanocephala*).
A pair of "múnál" (*Lophoplurus Impeyanus*).
A snow pheasant (*Tetraogallus himalensis*).
Pair of "khalij" pheasants (*Gallophasis Albocristatus*).
Pair of "cbir" pheasants (*Phasianus Wallichii*).
Snow partridge (*Lerwanivicola*).
Chakor (*Perdix rufa*) *Caccabis Chakor* (Jerdon).
The bird is said by natives to be enamoured of the moon, and that at full moon it eats fire.
Hill pigeons (*Columba casiotis*).
Black birds (*Merula boulboul*).
"Kokila" (*Eudynamys orientalis*).
A peacock (*Parp cristatus*).
The following were sent by the TEHSILDAR, Kúlú.
"Múnál" or "nilgir" (alive.)
Hen, do.—
Cheer or Charir pheasant.
Black birds (*Merula*).
Titars (*Perdix francolinus*).
Chakors (*Perdix rufa*).

in the Punjab. Several of the Peshawur sword scabbards were covered with a black leather, looking like morocco; it is probably an imitation.

The skins locally prepared are goat skins, calf and bullocks' skins, and camels' skin, which last dries into a very hard compact hide, and is made into "kuppas" and oil vessels; also into dishes for weighing scales, &c. Núrpúr, in the Kangra district, is celebrated for its preparation of red dyed skins, especially goat skins; they used to form a considerable article of trade, and went to the frontier to Yarkand by Ladákh, and still do so to some extent. Some of the leather articles exhibited show a considerable knowledge of leather-working, and are very soft; but there is nowhere exhibited any specimen approaching to kid, or like the useful chamois leather; the latter is indeed to be found in the Punjab, but only as a European import. Leathers are ordinarily met with dyed black and red, the latter being especially common, more rarely it is left of its natural color, for shoes, &c.

632.—[5523-26]. Series of leathers.
Delhi. (*a.*) Bullock's hide.

(*b.*) Skin of kid.
(*c.*) Camel's hide.
(*d.*) Buffalo hide.

633.—[8213]. Leather for shoes. Kurnal. LOCAL EXHIBITION COMMITTEE.

Sirsa. **634.**—[8219]. Hide. BANSIDHAR.

635.—[8249]. Goat skin, dyed red: Kangra. value; Rs. 1, from Núrpúr. LOCAL EXHIBITION COMMITTEE. The description of this manufacture is contained in Vol. II. Class XI.

636.—[8263]. A kakar skin: worth Hushyarpur. Rs. 2-4-0. Hushyarpúr. BALU.

Gujranwalla. **637.**—[5635]. Buffalo skin.

638.—[5634]. Goat's skin.

639.—[5637]. Bullock's skin.

640.—[8302]. Two skins of red leather. Gujrat. UMRAH.

641.—[8304]. Five skins of black leather. UMRAH.

642.—[8338-9]. Leathers, from Syadwalla. Gugaira. LOCAL EXHIBITION COMMITTEE.

643.—[8334] Red leather, from Hurrapa. LOCAL EXHIBITION COMMITTEE.

644.—[5681] Hide, from Palki. Hazara. DEPUTY COMMISSIONER OF HAZARA.

The skins are soaked first for 15 days in water and lime, after which it is cleaned and the hair removed: the skin is then sown up, leaving one aperture, and filled with particles of oak or cheer bark or bán (*Rhus cotinus*) leaves, and on these water is constantly poured until the skin is thoroughly saturated; the price is about Rs. 1 per hide.

645.—[5672]. Sheeps' skin, "khal." Peshawur. Peshawur. LOCAL COMMITTEE.

Used for making shoes. When the hair is not removed, they form postíns.

The soft black lamb skins of Karakul, before alluded to, are immensely prized for making postins and for coats: they are prepared by taking the skins of the young lambs immediately on their being born: this of course is an expensive method, and the skins are proportionately high priced.

646.—[8361]. Russia leather, "balghár," imported to Peshawur: value Rs. 25. MUNICIPAL COMMITTEE.

This leather is said to be made of the horse's skin, it is thick but pliant, and of most grateful fragrance. The skins are much valued for the preservation of merchandise, as insects will not attack them.

647.—[8362]. Green leather, "khal sabz." Kábul. Rs. 1-4 the piece. LOCAL COMMITTEE.

648.—[8363]. Imitation morocco. Kabul. Rs. 2 the piece. LOCAL COMMITTEE.

649.—[8364]. Black leather. Peshawur. Rs. 2-8 the piece. LOCAL COMMITTEE.

650.—[8366]. Another sample: worth Rs. 1.

651.—[8268-69] Inflated skins, "shiráz,"

These skins are used for crossing hill streams. They consist of the entire hide of the animal (buffalo) or (bull), with the apertures of the legs, neck, &c., carefully tied up. The passenger throws himself on one of the skins, which remains under his middle, he then propels himself by striking out with his legs and arms.

652.—[8348-8349]. Leather, by the TEHSILDAR AND MUNICIPAL COMMITTEE.

Dera Ghazi Khan.

SUB-CLASS (B.) BONES AND HORNS.

Already we have noticed the comparatively little use made of animal products. Bone is scarcely used at all, nor is there any specimen of it exhibited as used in any manufacture.

There is one specimen of ivory; an account of this will be found in Vol. II., under the head "Ivory manufactures."

Simla and Kangra exhibited several horns, as ornaments.

653. [ ]. Two pairs of ibex horns, "tungror." Kúlú and Lahaul. Local Committee.

654.—[ ]. Two pairs "thár" horns, called "karth." Kangra hills.

655. [ ]. Two horns, "singh kurrál." Kúlú.

There were also other horns (not catalogued) of the "thar," "gurál," buffalo, yák (*Poephagus grunniens*); some fine stags' horns, several of them from Bunnoo; but all exhibited as ornaments.

656.—[9260]. Elephant's tusk, Sirmúr. Raja of Sirmur.

This is a large fine piece of ivory cut at both ends, about 2 feet long.

657.—[ ]. Stags' horns, "shákh-i-hiran." Gugaira. Deputy Commissioner.

658.—[ ]. Buffaloes' horns.

SUB-CLASS (C.) ANIMAL FATS AND OILS, INCLUDING WAX.

FATS.

659.—[2511]. Bears' grease. Kangra hills. LOCAL COMMITTEE. Kangra.

660.—[2512]. Leopards' grease. Kangra hills. LOCAL COMMITTEE.

661.—[922]. Suet. Gugaira. LOCAL COMMITTEE. Gugaira.

662.—[923]. Bullocks' fat, prepared. LOCAL COMMITTEE.

663.—[924]. Buffaloes' fat, prepared. LOCAL COMMITTEE.

664.—[925]. Tigers' fat. LOCAL COMMITTEE.

Used medicinally.

OILS.

665.—[4211]. Wax oil, "raughan-i-mom." LOCAL EXHIBITION COMMITTEE. Amritsar.

A strong smelling oil, its odour exactly resembling that of a candle when suddenly blown out. A sample was sent from Dera Ghází Khán.

666.—[4296]. Raughán-i-bhírbhútí. RAM SINGH, Pansári. Lahore.

Oil of the red velvet insect, "bhír bhútí," that appears in the rains; the oil is used only in medicine, or as an irritant and blistering agent.

667.—[4400]. Raughan-i-pín. "pelican oil." TEHSILDAR OF DERA GHAZI KHAN. Dera Ghazi Khan.

Price, four chitacks per rupee. The bird is found the Indus at Mithankot, and the oil is made from its fat; one bird yields a quarter of a seer. The Persian name of the bird is *Fitan.*

668.—[4267]. "Raughán-i-baiz-murgh." Lahore. RAM SINGH, Pansári.

Oil from the shells of hens' eggs, obtained by dry distillation; used only in native medicine.

669.—[4409]. Scorpions' oil. TEHSILDAR OF DERA GHAZI KHAN.

This is made by steeping scorpions in oil; is used in medicine and as a cure for scorpion's bites: price 4½ tolahs per rupee.

WAX.

670.—[2499]. Wax, from Rewarí. DEPUTY COMISSIONER, GURGAON. Gurgaon.

671.—[2506]. Wax, from hills near Simla. MR. GEO. JEPHSON. Simla.

672.—[5630]. Purified white wax, from the hills near Gurdaspúr. C. A. D. GORDON, ESQ. Lahore.

673.—[5631]. Candles, prepared from hill wax. Lahore bazar. B. POWELL, ESQ.

Amritsar exhibits wax, No. 2515.

674.—[2533]. Wax. Jammú. H. H. THE MAHARAJA. Kashmir.

675.—[4168]. Wax. TEHSILDAR. Dera Ghazi Khan.

676.—[ ]. Wax. LOCAL COMMITTEE. Hushiarpur.

SUB-CLASS (D). ANIMAL FIBRES.

I. SILK.

We now come to the most important class of animal products, the only one which was tolerably fully represented in the Exhibition. Silk has been a product of India* from time immemorial, as also for a great length of time in Bukhárá, in Kashmír, to which places it was probably at some remote period introduced from Khuttan and China.

The specimens of silk exhibited are all the produce of the cultivated silk worm (*Bombyx mori*), the eggs having been obtained principally from Kashmír, Kábul, Bukhárá, and some few from Bengal.

It would be foreign to the purpose, and would quite exceed the limits of this work were I to attempt a history of silk, or an account of the rearing of silk worms. I have merely given here and there in the following list such particulars concerning the methods of cultivation followed in different districts, as may serve to show what are the facilities, and what the obstacles, to sericiculture; and to what extent success has hitherto been obtained in the Punjab.

Indeed there is little to be said on the subject of silk rearing that could be of any practical value, unless I were to go minutely into such details, as could only find place in a manual, or work especially devoted to conveying this information.

The main requisites for the successful rearing of the worms appear to be light well ventilated dry rooms, furnished with series of shelves around the sides on which the trays containing the feeding worms are placed,—a temperature equable and moderate,—and freedom from the attacks of animal and insect vermin.

The principal source of silk in these provinces, and in those on the north-western Frontier, which yield the great supply for the manufactures of Baháwalpúr, Múltán and Lahore, is, as already intimated, the cocoon of the *Bombyx mori*, or *Phalæna Bombyx mori.*

The Eria and Tussah silks are unknown. Yet wild silk is altogether unrepresented. At first a wild silk worm was noticed near Masúrí, by Capt. Hutton, which Mr. Westwood the entomologist pronounced distinct from *B. mori* and named *B. Huttoni*; since then, Lord W. Hay, noticed wild silk worms in the Simla States, called by Westwood, *Caligula Simla;* and in the Seeba territory of the Kangra district, Mr. R. Saunders writes† that, there are wild cocoons which are cut into thin bands or strips, and used to bind musket barrels on to the stock, such is the strength and tenacity of the compacted fibre of the cocoon. A similar use is ascribed to the Tussah silk (*Antheræa paphia,* Linn.) in the Madras presidency.‡

* The exports of silk from all India to all parts of the world have been, and value during the years, as follows :—

1850-51	Rs.	61,93,180	1856-57	Rs.	78,21,390
1851-52	"	68,86,400	1857-58	"	76,66,730
1852-53	"	66,75,460	1858-59	"	79,92,520
1853-54	"	64,24,750	1859-60	"	81,78,530
1854-55	"	50,01.060	1860-61	"	1,08,67,280
1855-56	"	70,77.050			

(Forbes Watson's Tables.)

† To the Curator, Lahore Museum, 1859.

‡ Jury Report on Animal Products, Madras Exhibition of 1855, p. 73.

The wild worms feed principally on the bér *(Zizypus jujuba)*. Mr. Macleod succeeded in collecting a number of these cocoons for a merchant (Mr. Lotteri) in Calcutta, who produced very beautiful raw silk from them. Mr. Cope has also reeled some of this wild silk. The process is not difficult, if the cocoons are boiled in water with any animal substance containing ammonia.

Whether the Simla and Masúrí species were ever cultivated or made use of formerly, it is impossible to say, but silk cultivation in this part of the territory now called Sirhind, appears to have been practised of old, being mentioned by Justinian.*

There is scarcely any Fibrous product either animal or vegetable, that is so curious as silk, both as regards its natural history and as regards the progress of the trade in it.

Silk first become known in Europe after the victories of Julius Cæsar, by his displaying a profusion of Chinese silks at a magnificent spectacle which he gave in the theatre; soon after this, small quantities of the manufactured article began to be imported, and were sold at the most exorbitant rates. Tacitus (Annals, II., 33) mentions that during Tiberius' reign, a law was passed to prevent men wearing silk garments, but latterly, under Heliogabalus, who clothed himself entirely in silk, the law fell into disuse; from that time forward silk became common, till about the year 370, it appears from a statement of Ammianus Marcellinus, to have been in common use even by the lowest orders. A large profit was then derived by the Chinese exporters of silk from the Western Empire, but at last eggs were clandestinely brought over to Constantinople in 550 A.D., and soon the manufacture spread to Greece. Thence Roger II., king of Sicily, after having ravaged the Peloponesus and Greece, carried back with him the knowledge of silk cultivation, which he established at Palermo whence it spread into Italy, Venice, &c. It seems also early to have been established in Spain. It did not reach France till about 1480, and the manufacture of silk at Lyons began in 1520.

England has never been a silk producing country, though the experiments of Mrs. Whitby, of Newlands, seem to show that by introducing a species of mulberry that bears leaves early in the season, such as *M. multicaulis*, the cultivation is quite practicable. Silk manufacture has however been carried on for ages, and has a peculiar interest from the experience

* The number of known species of silk producing worms is very considerable. The following is a list, which, however does not profess to be exhaustive.

Bombyx mori Linn. (*Phalæna*).
B. cræsi, Bengal.
B. textor (Hutton), Masúri.
B. Huttoni (Westwood), Do.
B. Horsfieldi (Moore), Java.
B. sinensis, Bengal.
B. religiosa (Helfer). The Joree worm of Assam.
Ocinara dilectula (Walk.), Java.
Attacus Atlas, Linn. (S. Atlas), China, &c.
A. Edwardsii, Sikhim.
A. guerini (Moore), Bengal.
A. Ricini, Assam.
Ailanthus (*Attacus cynthia*, Drury), Moore's cross between the Eria of China and that of Bengal, 1859.
Attacus cynthia, Drury, "Eria," China, Bengal, Assam.
Antheræa mezankooria (Moore) "Mizankúri silk."
A. Pernyi (Guer.-Men), N. China.
A. Perrottetti (Guer.-Men), Pondicherry.
A. Roylei (Moore), Masúri.
A. Helferi (Moore), Darjeeling.
A. Jana (Cram.), Java.
A. Frithii (Moore), Darjeeling.
A. Larissa (Westwood), Java.
A. Paphia, Linn. *(Saturnia Paphia)*, "Tussah" silk.
A. Assama, (Helfer), "Moogha" of Assam.
S. Silhetica, Dacca and Silhet.
Saturnia pyretorum (Westwood), China.
S. Grotei (Moore), Darjeeling.
Loepa Katinka (Westwood), Java.
Actias Selene (Saturnia selene), Darjeeling, Masúri, and also S. India, where it feeds on the *Odina wodier* "jinjan."
Caligula Thibeta, Masúri.
Caligula Simla, Simla.
Cricula trifenestrata, Java.
A species of *Lasiocampus*, feeding on the "Jáman" *(Sizygium jambolanum)*, and the Guava tree, is noticed in the Madras Report of 1855, p. 74.

it affords of the effects of a series of legislative blunders on a trade. The manufacture of silk comes prominently before us in the reign of Elizabeth, when the influx of workmen from the Low Countries gave a great stimulus to the trade. The silk "throwers" (those who prepared, by twisting, the silk fibres) where incorporated as a guild in 1629; and then began a series of legislative enactments each of which served only to augment the evil produced by the last. During this interval in 1685, the revocation of the Edict of Nantes, sent thousands more workmen to Spitalfields, and of course greatly increased the manufacture. To stimulate, as it was thought this manufacture in 1697, the importation of French and foreign silks was prohibited; and in 1701, the prohibition was extended to India and China goods. The effect of this was two-fold; first, it stopped all advancement of the manufacture to such an extent, that no one took the slightest pains to improve the looms or other machinery; so that in 1826, when at last the evil of the system was discovered, it was stated in Parliament, that there were abroad looms for ribbons, that could produce five times the quantity in the same time that the Coventry looms did! Secondly, the law proved utterly impotent to stop the importation, since it was calculated that between 1688 and 1741, when the prohibition was in full force, the imports were worth £500,000 *

In 1719, the first throwing mill was established at Derby, the machinery for twisting the *organzine* and *tram* silks, long used in Italy, having been clandestinely copied and brought to England. Accordingly, not only was the importation of silk fibres prohibited, but also of silk thread and organzine too. All these acts were crowned by the Spitalfields Act of 1773, which as McCulloch observes, "after having done incalculable mischief," was repealed in 1824. This fixed a rate of wages for workmen, *more* or *less* than which neither master could offer nor workmen accept. At last, in 1820, the effect became visible: England had equalled and rivalled her neighbours in all manufactures, *except silk*, in this no improvement had taken place! We were behind our other manufactures, and behind all our neighbours. In 1826, the majority of foreign silks were imported with a duty *ad valorem* of 30 per cent.; this rate gave great freedom for smuggling, since counting all the risks of illicit trade, they only amounted to 15 or 20 per cent. on the value, and hence the illicit trade was more profitable with its risks and all, by 10 per cent. then the legitimate; this evil was however subsequently rectified, and the duty so reduced as to render smuggling unprofitable. There seems to be no doubt that England will not rival France as a silk manufactoring country; the delicate colors and suberb finish of Lyons silks ever place them above competition.

The chief difficulty attendant on the rearing of silk worms appears to be the growth of suitable trees for their food. This has been felt in England as it has in the Punjab, but there is certainly a very wide field for enquiring as to the possible sources of nourishment: it has been often observed that caterpillars found on one kind of plant, will readily eat leaves of other species, but of the same natural order. Several species of *Bombyx* yielding silk in Assam and other places, live on the pepul and the bér.

Pípal, *Ficus religiosa*, is of the same natural order as the mulberry; it would be worth while trying whether the silk worm could not live on pípal leaves, to supplant mulberry. The bér tree (*Zizyphus jujuba*) abounds, and some species of *Bombyx* feed on it; perhaps others would also.

It is now time to proceed with a brief notice of the various attempts made to cultivate

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* McCulloch's Dictionary of Commerce. Art. Silk.

silk in the Punjab up to the present time, reserving notices of the manufacture of silk fabrics, as it at present exists, to Class VII., in Vol II.

The cultivation of silk certainly deserves to be perseveringly followed out in the Punjab. Not only is the Punjab the seat of silk manufactures of the first class—at its cities of Multán, Lahore, Amritsar, and the neighbouring state, Baháwalpúr—but it borders on Kashmír, long known for its productiveness in silk; and receives the trade of Bukhárá, the dyed and floss silks of which have been famous for ages. In our own times, much encouragement has been given to the introduction and cultivation of silk, both in Bengal, in the N. W. Provinces, and the Punjab.*

The Punjab seems especially suited for silk worms, particularly certain districts of it. The only difficulty as far as climate is concerned, is the great heat of the summer months. Everything but great heat the worms seem to stand. Silkworm cultivation has been accomplished in Sweden and in Canada; in England also attempts have been made. An English lady, MRS. WHITBY, of Newlands, has demonstrated the practicability of the English cultivation; she exhibited silk, hand-reeled, to the British Association, and a splendid piece of silk woven from her British cocoons was, it is said, presented to Her Majesty the Queen.

The difficulty in England, (and this is felt also in other climates,) is that the ordinary species of mulberry produce leaves too late in the season, and the young worms are hatched *before* there is food ready for their consumption; but MRS. WHITBY, overcame the difficulty by planting the species known as *Morus multicaulis*, which produces its leaves earlier than other species. There seems no reason then that sericiculture should not be carried on in the submontane districts of the Punjab, and even in many of the plain districts themselves; and it is encouraging to notice how the experiment has been determinately maintained, notwithstanding occasionally failures. Loss and disappointment will occur, in almost every new undertaking, at one stage or another, but happily we know by experience, that such difficulties are often the forerunners of unexampled success, and that they do not necessarily imply or prove that the theory is either faulty in principle or impossible in practice.

As early as 1847, silk rearing was attempted at Lucknow, by CAPT. HOLLINGS, who had received a supply of cuttings of the *Morus multicaulis* from Calcutta; the experiment was however suffered to drop when CAPT. HOLLINGS left Lucknow. More recently the experiment has been taken up with zeal by DR. BONAVIA, some of whose cocoons are exhibited from the Lahore Museum.

Much earlier experiments were however made in the Punjab, and earliest of all in the Cis-Sutlej States. So far back as 1836, DR. GORDON, Assistant to the political agent on the N. W. Frontier, commenced work. He built a silk house, and planted mulberry trees, which still exist; he carried on his experiments for three years, the latter year appears to have been the most successful. Owing to DR. GORDON'S transfer to another appointment, the experiment gradually fell off.

Among the hill states, LORD HAY, noticed in the valley of the Girí some wild silk worms,* which formed their cocoons in the rainy weather, and as mulberry trees abound even up to Simla itself, there can be little doubt of the success which would attend the cultivation of silk. MR. COPE, of Amritsar, mentions the valley of the Gambhír, including Sabáthú, as a likely place. Sirmúr and Kánawar might also be added.

At Ludhiana silk cultivation was attempted by COL. SIR CLAUDE WADE, who tried with some eggs obtained from Ladákh in 1836, by DR. ANDERSON. This experiment was also cut short after two years by the departure of its originator to Kábul.

At Hushyarpúr, COL. ABBOTT, the Deputy Commissioner (1852), attempted to rear the worms in the jail; he obtained 56 seers of cocoons, of which 32 seers were wound off, 8 seers were of coarse silk, 4 seers from the pierced cocoons, and 2 seers were of floss. COL. ABBOTT'S departure for England, drew this experiment also to a close.

At several localities within the Kangra district, silk appears to have been attempted. MR. MACLEOD, then Commissioner of the Trans-Sutlej States, writing of this part of the country says;—"I would at the same time point out the peculiarly eligible position of Núrpúr (in the Kangra zillah). It is situated at the foot of the hills, possessing as compared with the lower plains of the Punjab a mild climate, and

* The importance and value of the silk trade is not easily over-estimated. As far back as 1852, the imports from all quarters were 7,248,024 lbs., of which 2,466,605 lbs. came from China, 1,335·951 lbs. from Bengal, and 3,445,448 lbs. from other parts. No doubt the estimates of later years would show a very much larger quantity even than this.

* Both at Simla and Masúri a wild species of silk worm, named by MR. O. WESTWOOD, *Bombyx Huttoni*, has been observed on mulberry trees, they produced small cocoons from which silk was reeled by MR. COPE.—*See* his Pamphlet on Silk, addressed to A. H. Society of the Punjab.

it is the seat of a very large colony of Kashmíris, actively engaged in the shawl manufacture; one of these, some years ago, set up an establishment for rearing silk worms, as a means of livelihood, which, however the unsettled state of the times and his own poverty obliged him to discontinue; but he is anxious to resume it if encouraged."

Silk has been produced in the Mandí state. At Pattár Kot, on the verge of the district, in 1854, ALI BAKSH set up a manufactory, and produced some fine cocoons.

At Sujanpúr in 1852 and 1853, there were several Mussulmans, who for 8 or 10 years previously had obtained silk and sold it at Batálá for Rs. 11 per seer pucka; a similar effort was made at Mainakot. MR. BARNES, then Commissioner of the Lahore division, expressed strongly his opinion that silk could be produced in any quantity, and that Government should set the example of its cultivation. He added, that the Mainakot and Sujanpúr silk factories were proofs that the silk can be reared by the poorer classes with the certainty of profitable returns.

The cultivation at Sujanpúr, owing to the death of the proprietors, has disappeared.

At Amritsar, in former days, SIRDAR DESSA SINGH, father of LEHNA SINGH, reared some eggs he got from Kábul, and produced silk worth Rs. 7 or 8 a seer; but he only reared for his amusement and from curiosity. Of the present cultivation at Amritsar, I shall speak hereafter in noticing the specimens contained in the collection. In the same way also, the account of sericiculture in the Gúrdaspúr district under the management of JAFIR ALI is reserved for the sequel, under the head of JAFIR'S exhibited samples.

At Lahore in 1853, an attempt was made on a somewhat larger scale: eggs were obtained from Bengal, and an expert Superintendent was sent up.* Kashmír eggs was also obtained, and it soon became evident that they were far better suited to the province than the Bengálí eggs. In 1856, the number increased greatly, in fact it became beyond the power of the gardeners to supply fresh leaves enough. A large number of eggs and worms died, and what with other costs, the out-turn of silk, (Rs. 11,000,) was rather inadequate. There was about 5½ maunds of wound silk, and that of excellent quality.

At Gujranwalla, a man kept some worms reared from eggs he had obtained in Hazara. For three years he kept them for his amusement, but afterwards dropped the cultivation.

At Gujrát also the experiment was tried.

* This Superintendent, M. DEVERINUE, sent home some of the silk, which gained a prize at the French Exhibition, 1855.

In the Rawalpindi district, at Syadpúr, below the Hazara hills, a silk factory was started. It belonged to MIRZA SHAHWALI, the descendant of the Gukurs, whose ancestors in their palmy days planted an extensive garden of 1,500 or 2,000 trees, the greater part of which were destroyed by the Sikh army in 1848-49, owing to the MIRZA'S strong fidelity to the British cause. With the remainder, he established a small factory, which yielded him 5 to 6 seers annually which sold for 18 to 20 Rs. per seer, at Peshawur. MR. CARNAC adds, that there are many other localities in this district, enjoying the same irrigation advantages as Syadpúr, and situated at the end of the same range, commencing below Ghází on the Indus, and extending below Gandghar and Khánpúr to Gungalli in the Jhilam.

With regard to Peshawur, COL. JAMES, writes rather unfavorably; he states that the quantity produced at Peshawur was never large (not more than 4 maunds, and that of a coarse quality) and he thinks that the landowners would not be likely to take to planting mulberry gardens; he mentions that in Bukhárá and Kábul, the mulberry is grown from seed, by rubbing the seed into the twists of a rope, which is laid down in the earth; the young trees are allowed to grow till they are 4 or 5 feet high, when they are cut for use.

This unfavorable opinion is however scarcely justified by the results of the recent experiments in Peshawur, the details of which will be given in connection with the notice of the Peshâwur samples under this class.

The principal districts of which silk is imported into the Punjab are Buhkárá and Kashmír: the silk is imported both raw and in skeins ready dyed; and notices of the various kinds are given in the sequel, under the headings of Kashmír and Bukhára silk. The silk trade in the Punjab is of great value, it is stated by MR. DAVIS, to be nearly £200,000.* "Raw silk," he adds, "is imported from Kokand, Bukhárá, Balkh, Khulm, Akhcha, Shibrgaum, Andko, and Kashmír; from Saidábád, Murshedábád, Rampúr-Baulia, and Rádhanagi, in Bengal, and China *viâ* Bombay. No silk has been imported from Khutan, for the last four or five years. The raw silk is sent from Amritsar to all parts of the Punjab for manufacture: raw silk is the staple import by way of Kábul.†

* DAVIES' Report on the Trade Resources of the N. W. Frontier, p. 74.

† The above information is collected from a variety of sources but especially from "The Selections of the Punjab Government Correspondence;" MR. DAVIES' Report; and MR. COPE'S Lectures and Pamphlet on Silk in the Punjab, addressed to the Agri-Horticultural Society, also from LIEUT. POSTAN'S Memo, on the Silk Trade between Shikarpúr and Khurásán

CHEMICAL NOTICE.—Silk is secreted in a double filament from two orifices at the head of the worm, communicating with two secreting glands one on each side; as they pass out the two filaments are glued together into one by the secretions from a third central gland, of a resinous substance.

The yellow color of silk is attributed to resinous matter: accordingly a method of bleaching has been occasionally practised, which consists in removing the color by treating the silk with alcohol of a fixed specific gravity, acidulated with muriatic acid; after treatment the silk is washed with alcohol, and thus is rendered white, the alcohol acting as a solvent to the resinous coloring matter, and the chlorine of the acid aiding the bleaching. The spirit can be recovered, to prevent waste, by neutralizing the acid with lime, and distilling the liquid, when pure alcohol passes over. The more common method is to tie up the silk in cotton bags, which are boiled for some time with soap, and bleached, and as a finishing process, hung up in a kind of oven exposed to the fumes of sulphur.

The native process is similar to the latter. After boiling in a solution of sajji (carbonate of soda), the silk is washed several times with soap and water, and finally exposed as in Europe to the fumes of sulphur. It looses much weight by this operation (4 or 5 chittacks out of 16), showing that the coloring substance is a separable and ponderable substance, not inherent in the silk.

The solubility of silk is a curious property recently brought to light; and it is a property which if duly investigated, will be of considerable importance, not only as a means of detecting fraud, but as a useful means of turning to account waste silk, floss, pierced cocoons, &c., &c.

In Kashmir it is said that paper is made, called "reshami kágaz," or "haridi kágaz," from the refuse and pierced cocoons unfit for reeling. The following on the subject of silk solvents is an extract from the Athenæum of January 17th, 1863.

"Silk has been experimented on by chemists, and M. PERSOZ finds that a preparation of chloride of zinc will dissolve silk, which fact at once suggests a method for detecting the tricks of trade practised by silkweavers. Much of the woven silk, so called, sold by mercers and others, contains a large proportion of wool or cotton, sometimes both; but now all may be discovered by an easy chemical process. As above stated, the chloride dissolves the silk, but leaves untouched the wool and cotton; the wool in turn is dissolved by an aqueous solution of caustic potash, which leaves the cotton uninjured. M. OZANAM, in a recent communication to the Academy of Sciences at Paris, carries the question a step further by showing that the several operations may be accomplished in one single bath of ammoniuret of copper. Let the piece of cloth be plunged into this, and in a short time the cotton disappears; at the end of three, six or twelve hours, according to the strength of the bath, the silk is dissolved, leaving the wool intact. Thus the quality and proportions of the materials of the warp and weft may be easily determined. M. OZANAM explains that, by Mr. GRAHAM'S method of dialysis, it is possible with this bath to separate silk in the gelatinous form, taking care to use for the porous septum a substance that does not dissolve in the ammoniuret of copper. Parchment or paper would soon disappear. Having prepared a quantity of silk in the gelatinous state, as, in fact, it exists in the worm, it might then be possible to draw it out in threads of any length and of any thickness, and thus avoid the trouble of spinning by a process similar to wire drawing. Or silk cloth might be produced, either by a process of pouring out and rolling, or in endless lengths, after the manner of papermakers. And with this capability of reduction to the gelatinous condition, we have the means for reconverting old waste silk, woven or twisted, refuse cocoons and floss, to a useful and valuable article of commerce. These are a few hasty suggestions as to the way in which these interesting chemical results may be utilized; that many others will shortly be forthcoming is not to be doubted."

When silk is reeled, the thread as it is wound from the cocoon being twisted to give it strength, is called "singles;" two or more singles twisted together form "tram," weaving thread, short or weft. When two or more singles are twisted together in a twist of a direction contrary to that of the twist of the "singles," they form which is called organzine, and the art of performing this operation, is difficult and was unknown, in England, according to the Italian method till the establishment of the mills at Derby in 1719. The operation is called "throwing."

The following are the most noteworthy specimens of Punjab silks, connected with the names of which will be found various particulars of the local manufacture and trade.

677.—[ ]. **Raw silk in skeins.** Amritsar. LAHORE MUSEUM.

Amritsar.

"I have annexed a copy of the reports received by MR. COPE from Manchester,* through the Private Secretary to his Excellency the Viceroy, upon the silk which he last year raised at Amritsar. The

* Extract from a letter from the Financial Commissioner to Government, 30th May, 1862.

report in question is eminently favorable, and Mr. Cope considers the entire experiment of last year to have been completely successful, though on a very limited scale. This year he has been unsuccessful, owing he considers to the defective character of the accommodation supplied to his worms. But the success of last year, the continued success of the Kashmiri Jafir, at no great distance from Amritsar, and his own experience gained during a series of experiments extending through the past ten years, have satisfied him that if all necessary appliances be provided, there is nothing in the climate of this part of the Punjab to prevent the profitable rearing of silk worms.

"The produce by Jafir this year (of which a specimen accompanies this) is valued on the spot at 16 or 17 Rs. per seer of 98 tolas, while Mr. Cope's has been valued at 25 shillings per lb., or 25 Rs. per seer in England, which shows how great a difference in value results from superior reeling. The quality appear to be quite equal to that imported from the westward, and the main difficulty which Jafir has experienced is in preserving the eggs for which a cool temperature is indispensable. This object he secures by keeping them in a very deep taikhana, or underground room, at Majithia of Amritsar, while Mr. Cope purposes attaining the same end by sending them up to Dhurmsala. In the hope of operations being undertaken at Amritsar next season he has secured from Jafir 10 seers of eggs at 20 Rs. per seer.

678.—[5575-5594]. Series of colored silks. Bukhárá. Local Exhibition Committee.

- Rose colored.
- Blue green (sabz).
- Pink (guláhí).
- White.
- Orange.
- Yellow, "músta."
- Scarlet.
- Sosani (lilac).
- "Kasni guláhí," pale lilac.
- "Piázi," pale pink.
- "Tori pílá."
- Pale green.
- Grape colored, (angúri).
- "Pistáki" (color of pistachio-nut, bright light green).
- Pea green.
- "Zamrúti," emerald color silk.

679.—[5614]. Silk cocoons, reared at Kapúrthalla. Rev. J. S. Woodside.

Lahore Museum.

680.—[5615]. Silk cocoons, from Oudh. Dr. Bonavia.

681.—[5616]. Do., Faizábád, Oudh. S. Carnegie, Esq.

682.—[5617-18] Cocoons from Kashmír.

683.—[5619]. Cocoons reared at Lahore. Nazir Khairullah Khan.

684.—[5620]. Yellow silk, and white do. (inferior), produced by Nazir Khairullah Khan.

685.—[5622]. Silk worms' eggs. Chaudri Imam Baksh.

686.—[5623]. Raw silk. Bijnour. Rev. T. T. S. Hauser.

687.—[5627-28]. Samples of silk, from Kangra.

688.—[ ]. Series of skeins (floss silk) from Bukhára but dyed at Lahore. White, black, green, crimson, orange, scarlet, blue, yellow. Lahore Museum.

Lahore.

The country bordering on the river Oxus and the canals and water-courses from Samarkand and Shahi-sabz, is full of mulberry trees, on the leaves of which silkworms are fed. About ten days or a fortnight after the mulberry trees put forth their leaves, the eggs of the silkworms are removed from the place where they had been preserved during the winter, and being wrapped in a cloth, are carried against the naked breast, or still oftener under the arm-pit. Three to five days are quite sufficient for the little insects to be hatched. They are then placed in a vessel and fed with the leaves gathered from the mulberry; after ten days the worms, according to the expression of the Bukhárians, fall into their sleep or trance, they take no nourishment three days running, repeating the same process every ten days, until the time they begin to spin the cocoon. When these are finished, the worm inside is destroyed by exposing the cocoon to the heat of the sun. That done, the Bukhárians proceed to reel off the silk threads The quality of Bukhárá silk is much inferior to that of China, and even to the French and Lombard silks, both in color and softness.*

The silk annually produced in the Bukhárá ter-

* Davies' Report, p. 15.

ritory is estimated to be worth 15 lacs. The greatest quantity is exported to India. There are several descriptions of silk.

1. Lab-i-abí, produced in banks of rivers and canels.

2. Vardánzai, produced in the district of that name to north-west of Bukhárá.

3. Chillá jaidar, produced in the environs of Bukhárá—this is the best.

In the description of articles found in the bazars of Kábul by the mission in 1838, we find the following account of Bukhárá silk as imported into Kábul. Raw silk chiefly of the fertile districts of Bukhárá, Kohkán, and Kundaz, is imported to the extent of about 4 lacs of rupees; about 200 camel loads of silk, each containing at an average 26 seers of Kábul, arrive annually at this great commercial mart from different parts In its original state it is usually of a gray-yellowish color, and is sold at from 90 to 100 Rs. per seer, or 16¼ lbs. English. It is here sorted into different kinds, dyed of various colors, and woven into "shúja khání," "kánávaiz," and other plain silk fabrics. It passes in transit to India and the Punjab. It is imported also from Herát, Mashhad, Shahr-i-sabz, Yarkand, Khulm, and Mazár, and is reared at Kábul in small quantities. It is generally of six different sorts. "Imámí," "kundúzí," "charkhi." "lab-i-abí" "shahr-i-sabzi," and "kokhání."

689.—[5549-50]. Silk from Núrpúr, (two samples). LOCAL COMMITTEE.
Kangra.

690.—[5633]. Silk. LOCAL EXHIBITION COMMITTEE.
Gujranwalla.

691.—[5640]. Cocoons reared at Gujrat. LOCAL EXHIBITION COMMITTEE.
Gujrat.

692.—[5641]. Silk reeled, from do.

In April 1863, a few chittacks of silk worms' eggs were supplied to the Deputy Commissioner of Gujrát. The ordinary precautions only were taken in securing the hatching of these eggs. The worms were placed in an empty house in the town, and were fed with the leaves of the native mulberry tree, which is grown to some extent in the neighbourhood of Gujrát.*

693.—[5657]. Silk. LOCAL EXHIBITION COMMITTEE.
Dera Ismail Khan.

694.—[5664]. Silk, from Bukhárá. LOCAL COMMITTEE.
Peshawur.

* LOCAL EXHIBITION COMMITTEE, Gujrát.

695.—[5665]. Series of silks dyed at Peshawur, the silk being the produce of Bukhárá.

696.—[5666-68]. Silk from Akcha, in Balkh.

[5001] Lab-i-ábí silk, from Bukhárá.

[5002] Charkhi silk, from Bukhárá.

[5003] Kokháni silk, Kokhán.

The silks of Bukhárá and Kandahár are imported either *viá* Shikárpúr, through the Bolan and other western passes, or else to Peshawur by the Khaibar and other northern passes.

The following are the descriptions of the raw silk with the prices of each in the Shikarpúr bazar, import duty paid (at Rs. 1-6-0 per maund):—

1. Kokání, from Bukhárá (produced in Túrkistán), price at Shikarpúr, Rs. 10 per assár.*

2. Túní, from Herát; price Rs. 13-12-0 per assár.

3. Shál-báfí, from Herát; price Rs. 15-10-0 per assár.

4. Nawábí, from Bukhára; price Rs. 14-12-0 per assár.

5. Gheilání, from Kirmare and Yazd; price Rs. 9-0-0 per assár.

6. Kalúchir, from Herát; price Rs. 9 per assár.

The value of annual imports may be about Rs. 50,000, and the route is through the great pass of the Bolan.

A quantity of Kábul and Bukhárá silk is also imported into Múltán and other places, to meet the demands of the great silk factories. The following account of silk at Múltán has been communicated by LIEUT. CORBYN, Assistant Commissioner.

It has been ascertained from the best and most reliable sources that about 300 packages of 1st, 2nd, and 3rd quality raw silk, weighing in all 750 maunds, the price of which averages to Rs. 3,75,000, are imported annually into Múltán from Kábul, Bukhárá, Khorásán and Herát. Of this, 225 maunds, valuing Rs. 1,12,500, are exported to the following places, viz., Baháwalpúr, Karáchí, Bombay, Dera Ghází Khán, Shikarpúr, Sakkar, Haidarabad, Súratbandar, Delhi, Farrakkabad, Bikanir, Sir-

* Silk, raw and prepared, is weighed at the rate of 90¼ Shikarpúr Rs. to 1 assar; 90¼ Shikarpúr Rs. equal in weight 88¾ new Company's. The present exchange between the two currencies is 94¾ Company's per 100 Shikarpúr, or 5¼ per cent. in favor of the former. Nos. 1, 2, 5, and 6 of the raw silks, above enumerated, are prepared for weaving, and dyed at Shikarpúr; the Shal-bafee and Nàwabi (Nos. 3 and 4) are manufactured at Rori, on the opposite bank of the Indus, into a coarse silk fabric, known as daryai.—LIEUT. POSTAN'S Memo.

sa, Ajmír, Benares, Lahore and Amritsar, &c.; 225 maunds of cleaned silk, after being dyed various colors, valuing Rs. 1,12,500, are also exported to Jhung, Karáchí, Pindibhuttían, Chiniot, Bunnoo, Dera Ghází Khán, Dera Ismail Khán, Leia, and Sakkar.

The remaining 300 maunds of silk, priced at Rs. 1,50,000, after undergoing the process of cleaning, are applied in the manufacture of the following description of fabrics, viz., dopatta, daryai, gulbadan, súsí, mashru, and lunghi, which are partly used here and partly exported to Shikárpúr, Haidarabad, Sakkar, Karáchí, Dera Ghází Khán, Dera Ismail Khán, Leia, Jhung, Chiniot, Kamáliya, Lahore, and Amritsar.

The following is an account of the approximate cost of dyeing :—

Kirmjí, or crimson,	2 Rs. per every seer of silk.		
Sabz, or green,	1	„	„
Siyah, or black,	1	„	„
Zard, or yellow,	1	„	„
Gul-i-ánár (*i. e.* scarlet),	8 Rs.		„
Safed, or white,	6 Rs.		

697.—[ ]. Cocoons reared at Peshawur, with the silk reeled from them. LAHORE MUSEUM.

The following is derived from MR. SCARLETT's account of the rearing of silk at Peshawur, dated 11th July, 1863.

The stock of eggs to experiment with was as follows :—

35 tolas from Jalálábád, procured through MUHAMMAD AZIM, Puracha.

16 tolas from Bukhárá, through JAN MUHAMMAD.

14 tolas, acclimated (from last year's out-turn).

120 tolas, procured through LIEUTENANT POWLETT from JAFIR ALI, making a total of a little more than 4½ lbs.

Three parts of the district were selected for the experiments, Peshawur itself; (2) the village of Khazána in the Dá'údzai pergunah, the locality of previous experiments; and (3) Charsadda, beyond the Kábul river, in the Hastnaggar tahsil.

The Charsadda branch, though personally supervised by MUHAMMAD KHAN, failed altogether. The eggs are said not to have hatched at all; part of them had been procured from Bukhárá and part produced at Peshawur. The cause of the failure has not been explained. I attribute it to some mismanagement of the eggs, for as regards climate, Charsadda varies little from Peshawur.

The Jalálábád eggs were tried at Khazána. MUHAMMAD KHAN's family, accustomed to be employed in this way for the past two years, undertook the management, and were successful. The only accommodation the worms had was a primitive guest house, or hujra.

The Peshawur silkery comprised the produce of the 120 tolas of eggs got from JAFIR ALI. JAN, a silk grower in former times, was immediately in charge. The rooms over the eastern gateway of the Gorkhatri afforded ample and suitable accommodation.

No artificial means were employed to assist the process of hatching. The eggs were kept in an open basket on the sunny side of the room, average temperature 76°. I have had reason to regret the omission of artificial aids. The hatching was irregular, and 24 tolahs of the eggs showed no signs of vitality; moreover, the latter worms were inferior, and produced bad cocoons.

The worms appeared simultaneously with the mulberry leaves (7th March). They were removed daily into large wooden trays placed on the floor. For the first few days the tender leaves carefully stripped from their branches, were supplied; but as the worms grew stronger, the branches themselves were strewn over them.

The consumption of leaves rose from two to fifty loads a day. According to experiments made in France, every ounce of eggs requires 20 quintals of leaves. The Peshawur worms must at this rate, have devoured 85,120 or 212 lbs., for every ounce of silk they subsequently produced. There was some trouble and a good deal of expense in collecting that supply. The zemindars objected to the use of their plantations, and justly so. The mulberry is, with rare exceptions, the only tree that grows abundantly about their fields, and affords them shelter during the summer months. Our supplies had therefore to be drawn from trees growing along roads or on Government lands.

Three kinds of mulberry flourish in the valley. The white variety (*Morus alba*) is the most common, and was principally used. In an experiment conducted by LIEUTENANT HUDDLESTON, lettuce was substituted for a time, and as far as I can judge, with no inferior results. He had procured some eggs for a friend; they were forgotten on the mantle piece. The next intimation of their existence was conveyed by the worms themselves. They were prematurely hatched owing to the heat of the chimney; and in the absence of mulberry leaves, had to be fed on lettuce. The natives, however, look on the mulberry leaf as the only natural aliment of the worm, and this view is confirmed by the experiments instituted in different parts of Europe.

The average period of the worm's existence anterior to the production of the cocoon, proved to be fifty days. There were the usual intervals of sickness

during which the worm declined all nourishment. As soon however as it cast its skin, its activity or rather appetite returned.

About the fifty-first day it gave up eating altogether, and moved about seeking a quiet corner wherein to undergo its impending transformation. The time for spinning had now arrived. Light bundles of brushwood were arranged along the trays and were soon covered over with cocoons in their various stages of developement.

Forty-eight hours appeared to be the average time occupied in the formation of the cocoon. The worm though no longer visible to the eye, is known to exist by the noise produced by its labors. As soon as this noise ceases, the cocoons are gathered.

On the whole the worms were as healthy as could be expected. Here and there some assumed the jaundiced appearance unmistakeably indicative of disease; these were at once removed to avoid contagion.

All diseases are ascribed to either—first, the use of damp floors or leaves, electrical state of the atmosphere, overcrowding, want of ventilation, insufficiency of nourishment; and these ascriptions have been corroborated by European experience; secondly, the presence of evil sprits and of unclean persons. I need hardly add that these subtle enemies of the worm have as yet evaded the closest European scrutiny.

It is a lamentable fact that the diseased worm cannot be doctored, so in the absence of means of cure certain preventives are adopted, such as ventilation, cleanliness, fumigation. The first two call for no particular remark. The third is a simple process. Earthen stoves lighted in different parts of the silkery are occasionably sprinkled over with "ispand" (Persian), a grain to which native superstition ascribes the virtue of scaring evil spirits.* I am at present unable to say whether it possesses any value as a disinfectant.

Disease however is not the only enemy of the worm. Rats, mice, and birds have to be equally guarded against. The Khazána silkery suffered considerably from their depredations, as the accommodation was not such as to afford immunity from their attacks.

The cocoons varied in size and color. The largest weighed, deducting floss silk and worm, about 5 grains, the smallest scarcely a grain; most were of a light yellow color, while the rest were either straw-colored or white. The first are said to yield the finest silk.

The out-turn was separated into two parts. About 12 seers were deposited in a cool place. The chrysalis continued dormant nearly a week, after which the full grown moth forced its way out. The process of regeneration occupied two days, resulting in 115 tolas of eggs; each female moth contributed on an average 250 eggs, weighing nearly 11 grains.

No attempt was made to keep the female moths separate from each other during the time of laying, or subsequently to select from the eggs produced; but these points are of considerable importance, and as sericiculture extends in the valley, the establishment of a shed for the re-production of healthy eggs will become very desirable. Nine-tenths of the diseases that decimate silk worms, are no doubt inherent in the eggs themselves.

The second batch of cocoons intended to be reeled, needed different treatment. It involved the ungrateful task of destroying the worm. It has just been remarked that the moth forces its way out of the cocoon; and although in doing so it does not break the filaments, but simply pushes them aside, the puncture is fatal to the reeling process. The cocoon gets filled with water and sinks to the bottom of the basin, thus rendering the unwinding impracticable.

To avoid this, the cocoons were exposed to the sun for a few hours on three days, consecutively. This treatment generally suffices; but to make certain some of the cocoons were ripped up, and the chrysalis was pricked. There was no sign of animation, otherwise a longer exposure had been necessary.

The next operation was the removal of the floss-silk, or the white filaments enveloping the cocoon. This was easily done with the hands. The cocoons were now ready for reeling.

A cocoon may be unwound with the hand. The filament is found to be continuous, and in the largest cocoon, measures nearly a thousand yards; but as it is too fine to be of any use singly, and mere hand-labor would be too tedious and expensive, the aid of machinery has to be supplied. In Europe there are various contrivances more or less complicated. The simple method adopted here is almost identical with what prevails all over Central Asia.

The cocoons are thrown into the basin, which is previously filled with water and heated. A few minutes immersion suffices to dissolve enough of the gum to loosen the filament. The mass is now beaten up with a switch, to which the disentangled ends of the silk readily adhere. These ends having been drawn up are put together in numbers proportioned to the thickness of thread required, and are then passed on to the reeling machine, in which the thread first passes through a narrow eye or loop, over a pulley, and then is fixed to the reeling bobbin. The loop or eye pre-

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* Isfand or "harmal," *peganum harmala*: the wild rue of botanists, abundant on waste ground in the Punjab.

vents impurities passing on and reduces the proportion of gum in the thread. The average number of filaments composing the Peshawur thread (double) is eighty.

Two men are required to conduct the operation. While one forms and watches the thread, the other reels it on the bobbin. About a pound of silk may be reeled per diem.

The arrangement is, however, defective in a material point. It fails to produce sufficient evenness in the thread.

The total quantity of silk produced was 25 lbs. In addition to this there were

10 lbs. of "surnukh," or coarse ends.
8 „ of punctured cocoons.
52 „ of refuse (floss-silk, &c.)

The following calculation will show the relative proportions of the constituent parts of the cocoon:—

	lbs.	oz.
1,000 cocoons, weighed, ...	1	0
Deduct floss-silk and impurities adhering thereto.	0	6
Worm and glutinous matter, ..	0	8
Balance, or silk, ...	0	2

The average quantity of silk produce from each cocoon is two grains.

It will be interesting to compare the silk produce here with that imported from Central Asia as regards market value. This article is not imported from Kashmir, and the European produce is too superior to admit of any comparison.

	Price per Peshawur seer of 104 tolas.
No. I., Peshawur, ...	16 Rs.
No. II., from Vardanzai, ...	17 „

This is the best silk procurable at Peshawur. Its superiority consists in the fineness and evenness of its thread. Vardanzai is one of the seven "tomans," or perganahs of Bukhára, situated about 35 miles north west of the capital on the caravan route to Orenburg or Troitska.

No. III., from Akcha, in the province of Balkh, ...	16 Rs.
No. IV., Lab-i-ábí, corruptly called Nabábí, from Bukhára, ...	14 „

Burnes' in his papers on the kingdom of Bukhára remarks with reference to this silk:—

"The most valuable insect is the silk-worm, which is reared in all parts of the kingdom where there is water. Every stream or rivulet is lined with the mulberry, and the most extensive operations are carried on along the banks of the Oxus, where the whole of the wandering tribes are engaged in rearing the insect. The silk of the Lab-i-ábí or banks of the river, as it is termed, is the most valuable, both from the softness and fineness of its thread."

The Lab-i-ábí districts extend along the Oxus and are called

1. Nárázi, ...	3. Charjáí,
2. Kahi, ...	4. Utir.

No. V., from Khulm, called charkhí,	13 Rs.
No. VI., from Kokand,	10 „

Pursuant to this experiment, a meeting of the principal members of the commercial community was called, and the whole subject was discussed. All present agreed in the desirableness of extending operations, and in the necessity for exertions on the part of the people themselves. It was resolved that a commercial company should be formed. A paper embodying the following propositions was thereupon drawn up and signed:—

I. That a company be formed, consisting of twenty shareholders paying Rs. 50 each.

II. That members possessing land cultivate as many acres as they can spare, with the mulberry, on the condition of being remunerated.

III. That the Paracha members arrange to procure a supply of eggs from Bukhára and elsewhere.

IV. That three or four families of silk rearers be invited over from the nearest silk growing districts, and encouraged to settle at Peshawur.

Active measures are on foot to ensure the success of this object.

The supply of eggs for the ensuing season will probable be:—

115 tolahs acclimated at Peshawur.
160 from Jafir Ali.
360 from Bukhára.

635 tolahs, or nearly 16 lbs.

The silkeries are intended to be as numerous and as widely scattered over the district, as the agency at command shall admit of.

About 32 acres of fresh land are being planted with the mulberry. It was intended to introduce the large leaved species *(Morus multicaulis)*, but the latest trials in Italy have shown that it is not suited for the silk worm.

An invitation has been sent to some families of silk rearers to immigrate from Kujja, a district in the vicinity of Jalálábád. I am assured there will be no difficulty in effecting this.

The families thus obtained, with those already in the valley, will afford all the necessary subordinate agency, while the members of the company now formed, will undertake the direction and supervision.

It will be interesting before closing this notice of the Peshawur samples to give the results of a microscopical examination, showing the breadths of the

filaments of these and other silks.* Dr. Brown writes, I have examined microscopically the specimens of silk sent by you, and that I find the diameter of the threads varies considerably in different specimens."

"In No. 1, the diameter was $\frac{38}{4500}$ of an inch; No. 2, $\frac{14}{4500}$ of an inch; No. 3, $\frac{35}{4500}$ of an inch; No. 4, $\frac{9}{4500}$ of an inch; No 5, $\frac{21}{4500}$ of an inch; No. 6, $\frac{35}{4500}$ of an inch. Subsequently, I examined two specimens of silk brought by H. Cope, Esq., and stated to have been prepared by a native named Jafir: I found them rather irregular in the diameter of the thread, but the average breadth was $\frac{18}{4500}$ of an inch."

698.—[ ]. Cocoons, reared by Jafir Ali. Gurdaspur.

699.—[ ]. Series of Raw silk, reeled by Jafir Ali.

The following is extracted from Mr. Powlett's account of the Gurdaspúr Sericiculture.

"On my way to Durreah Pattan, I ascertained that considerable interest is felt by the neighbourhood in Jafir's proceedings, increased no doubt by the jealousy he displays lest any one unconnected with himself should attempt silk cultivation, which he would fain keep as a monopoly in his own family. I was told that many would be glad of eggs, but Jafir had refused to part with any; and indeed, would allow no one near his worms, not even his own son. His objection to allow any one to approach the worms does not arise so much from jealousy as from a superstitious fear of the evil eye, to which fatal sickness among silk worms is I believe attributed all over Asia.† Jafir told me that English gentlemen were alone permitted to see them.

On my reaching to Durreah Pattan, the first thing Jafir insisted on showing me was the medal obtained for him by Mr. Cope, from the Agri-Horticultural Society. He carries it about with him and seems not a little proud of it. He told me that he had been established at Durreah Pattan some 20 years, and that he originally learnt silk rearing at Peshawur, where formerly valuable silk was raised: there were two establishments for the purpose when he was there.

I particularly questioned him regarding his stock of eggs, and the measures he adopted for preserving them during the heat, as I was anxious to ascertain whether there was any trace of deterioration in the worms from plain raised eggs, or whether renewal from the hills was beneficial. He assured me that so far from deteriorating, acclimatised eggs were far better than hill raised, as the latter produced in the plains sickly worms, many of which died in skin casting; on his commencing business he found it necessary to procure eggs from Peshawur as the Kashmír stock he had was unprofitable, and ever since, that is for 20 years and upwards, he has raised his own eggs, keeping them during the hot weather in a taikhána at Majeetha in the Amritsar district. This method of preserving them is not however satisfactory, as from a fourth to a third is always destroyed by the heat. Jafir showed me a quantity so destroyed, for the most part the heat had dried up the eggs without hatching the worms. Those that survive the heat are not injured but produce as healthy and fine worms as if the eggs has been kept in a cool climate; this the state of Jafir's own worms clearly demonstrated, but it would undoubtedly be a great advantage to establish (when silk cultivation has extended itself) a depôt on the hills where eggs may be kept during the hot weather. The carriage backwards and forwards would probably not cost 2 annas a seer, whereas the loss by keeping them in taikhánahs in the plains is (reckoning their value at Rs. 16 a seer) 4 or 5 Rs. a seer; out of taikhánahs the eggs cannot be preserved in the plains at all.

None of Jafir's worms had commenced spinning when I saw them (April 7th): they were of various ages, some would begin spinning in four days, some in six, some not for ten or twelve or even fifteen days; these last three sets were not of much value.

As I was under the impression that the silk worm was very delicate, I was much surprised to find Jafir's, though under such poor shelter and so crowded, looking so fine and well. Two old pauls and five or six sheds both very low, and the latter ill-ventilated, contain the whole of his stock. A hovel 30 feet by 16 feet scarcely high enough to allow a man to stand upright held sufficient to produce three seers of silk: there was nothing to keep them off the ground beyond the accumulation of mulberry branches, which were removed but once in ten days. They occupied the whole ground of the shed, with exception of a passage 1½ feet wide down the centre. In the pauls the worms lay as thick as in the sheds, there was nothing beyond a single fly to keep out the rays of the sun, for such trees as were near the pauls gave little shade.

In answer to my queries about the value of the

* The measurements are obtained from the Report by Dr. T. E. B. Brown, Chemical Examiner for the Punjab, in his letter to the Financial Commissioner, dated 15th August, 1863.

† The same prejudice exists on the part of the men (usually of the bearer or kahar caste) who tend the tusar or wild silk. From the time when the worms are hatched and placed upon the trees in the forest which they have previously prepared for their reception, they will watch carefully that nothing from without may come near them, keeping themselves at the same time most punctiliously apart from all that might render them ceremonially impure.

silk he produced, JAFIR told me that last year he sold it at Rs. 15-8 a seer, and this seemed the average rate. As I happened to have made notes of the value at Peshawur, of different descriptions of imported silk, I can assert that the above is a higher price than is there obtained for the common Kokan, Bokhara, and Khulm silk, and within a few annas of the value of that called Lab-i-ábí, which is raised on the banks of the Oxus, where the best Central Asian silk is I believe produced. JAFIR himself admitted that his profits were amply remunerative, and the impression in the vicinity is that he is wealthy, and that too in the face of the considerable disadvantages.

JAFIR informed me that a seer of good seed (eggs) should produce 21 seers of silk, or if the silk is sacrificed, the same weight of eggs; for it is said that the amount of seed produced by a given number of worms is equal to the amount of the silk which would be yielded by an equal number, and this the price of seed (16 rupees a seer) in Kashmír bears out. The amount of silk that a certain number of cocoons will yield varies very much; JAFIR told me he had sometimes got two seers of silk out of one seer of dried cocoons, but sometimes not even one seer: the best cocoons should yield one seer for five. He knew nothing of cross breeding, never having tried it. He raises silk but once a year, I believe it is possible to have a second crop; but JAFIR said that it could never pay as the leaves lose the nourishing properties in the heat of summer: he seemed to think too, that young tender leaves were necessary for the young worms. I should think JAFIR was right on this point with reference to silk culture in the dry plains, though in the hills it may be different. He feeds his worms morning and evening. The leaves should be as fresh as possible; but are dangerous if given wet.

JAFIR winds his own silk; he said that he could wind four seers a month, working up to 12 o'clock in the day, which over a fire in the hot weather is as much as he can comfortably manage. If hard put to it, he could wind six seers a month. When winding, three assistants are necessary to keep up the fire, &c. The dry branches of the mulberries from which the leaves have been stripped, are sufficient to keep the pot that holds the cocoons boiling, so he is put to no further expense for fire-wood. The cocoons from which moths have been produced are worth 2 Rs. a seer, being many times lighter than cocoons containing the chrysalis. The latter cocoons when dried vary in value from 8 annas to 1 rupee a seer.

More recently various relatives of JAFIR have taken to growing silk, and the following extract from a letter read to the Agri-Hor. Society of the Punjab in July 1863, will show how they succeeded.

One of the persons alluded to is named SUBHAN; he is the son-in-law of JAFIR, and learned the art of reeling silk from his wife, who has learned it from her father. The experiment described was made in 1863.

"SUBHAN had half a seer of eggs of his own, and bought another half seer at Sajánpúr. He hired the ante-room of a Hindoo temple for Rs. 5, and has, notwithstanding the losses he incurred, obtained cocoons enough to reel between 13 and 14 seers of silk. The following is a statement of the financial result of his operations, which shows that silk rearing is profitable even on this small scale. It is beyond a doubt that silk rearing would extend rapidly amongst the Mahomedan population in the neighbourhood of Nainakote, Nerote, &c., if the cultivation of mulberry trees were largely encouraged in the perganah :—

"Cost of one seer silk worms' eggs,	Rs.	11	0	0
" of mulberry leaves,	"	10	0	0
Paid coolies for gathering and bringing in, ...	"	25	0	0
House-rent, ...	"	5	0	0
Own wages, calculated at 5 Rs., for 5 months, for tending worms and reeling, ...	"	25	0	0
Wages of an assistant, at Rs. 2-8,	"	12	8	0
Cleaning silk at 12 As. per seer,	"	10	8	0
Interest on money borrowed, ...	"	0	3	0
Total	Rs.,	102	0	0
Nett proceeds of 14 seers of silk, at Rs. 16-8 per seer, ...	"	204	8	0
Leaving a nett profit on the season's operation of, ...	"	102	8	0

or more than 108 per cent. per annum.

"JAFIR tells me that he will turn out about 35 seers of silk and eggs, which at the same rate will have yielded him a profit of Rs. 270.

"There is no reason for believing that SUBHAN has understated his expenditure (the tendency would be the other way) and I know that the silk realized the rate he mentioned.

"Besides the silk reeled there are about 2 Rs. worth of cheshum (refuse), and he has one seer of eggs for next season.

"I collected materials in 1862, from which I estimated, on fair grounds, the total out-turn of silk in zillah Gúrdaspúr at, if I recollect right, 56 Lahorí seers, equal to nearly 140 pounds, valued at about 850 Rs.

"I have now ascertained that the out-turn of this year has been about 80 Lahorí seers, or about 195 lbs., produced in the following proportions :—

JAFIR ALI of Derеea,	34	seers.
ROMANA, his son,	9	"
ALLADITTA, his brother-in-law,	4	"

HATA, another brother-in-law,	4	seers.
SUBHAN, his son-in-law,	13	"
MUSTAN SHAH, of Sajánpúr,	14	"
Total,	78	"

"Besides, they have amongst them about 10 seers of eggs for next year's operation; the value of this year's silk is about Rs. 1,380, showing an improvement in money value of about Rs. 500, and an increase in quantity of 35 lbs. JAFIR has obtained a grant of 10 ghumaos of land in the Shakarghar perganah, from an over large encamping ground, and has applied to me for cuttings of the Chinese and Philippine Island mulberry plants, which he shall have to the extent of my means."

700:—[5692-99]. Series of skeined and twisted silk, dyed at Srinagar. White, black, Turkis blue, crimson, scarlet, and green of three shades. H. H. THE MAHARAJA.

Kashmir.

In Kashmir the houses where the silk worms are kept do not differ from the dwelling places of the inhabitants; indeed, in many instances the raisers and their families live under the same roof with the worms. The single spacious loft which ordinarily constitutes the upper storey of the houses occupied by by the lower orders in the valley, is generally the principal breeding room. The silk raisers (called "kirm kash") do not confine themselves to the production of silk, but are either agriculturists or shawl weavers besides. One individual has not usually charge of more worms than are sufficient to produce 30 seers of silk. The eggs begin to hatch about the middle of April, and during the first few weeks of the worm's existence, an untimely fall of snow frequently injures the owner's prospects; this year a fall in May did much mischief. Drought, as it affects the yield of mulberry leaves, is no less baneful. It is satisfactory to know that the interests of the Punjab silk raisers can never suffer from unseasonable cold, and he will thus have an advantage over his brother of Kashmir.

I was informed that for some years past there have been unfavorable seasons in Kashmir, but I could not discover there was any known disease among the worms; undue cold or drought and the difficulty of procuring coolies to collect leaves were the causes assigned. Paucity of laborers is a serious obstacle to silk cultivation in Kashmir; in addition to causing the worms to be insufficiently fed it must occasion a want of proper cleanliness. The importance of this last, however, is not fully appreciated by the raisers.

In the plains the worms exist for 38 or 40 days only before they begin to spin; but in Kashmir, owing to the comparative coldness of the climate, they live nearly twice as long. This then is a third advantage over Kashmir that the Punjab possesses, for the expense of attendance will of course be in proportion to the length of the worm's life, and I presume the same is true of the quantity of food consumed. Round Srinagar the spinning seemed to be at its height at the beginning of July.

A fourth advantage the Punjab may have will be superior winding (the Peshawur and Bukhára winding even is far better than the Kashmir); and a fifth, and the greatest of all, will be an immunity from an oppressive silk duty, and a harassing interference on the part of the Government.

No particular precautions against cold are necessary for preserving the eggs during the winter; they are usually kept in an earthen vessel, with the mouth of it secured (of course the vessel must not be placed any where near a fire, otherwise the eggs will hatch). I do not speak confidently, but as far as I can make out, excepting that mulberry leaves are procurable free of cost (a boon equivalent to less than half the amount of tax exacted), a greater facility in preserving the eggs is the only decided advantage, which Kashmir, as a silk raising country, has over parts of the Punjab plains; and this is not a considerable one, for eggs will probably be conveyed to and from the hills for less than one per cent. of their value.

I heard of several attempts in Kashmir to raise a second crop of silk during the year, but none had been successful. The failure was attributed to the unfitness of the old mulberry leaf for the young worms. I imagine that the leaf loses its nourishing properties as the season advances.

The male or fruitless mulberry (khassee) is in Kashmir the kind most valued for its leaf; which, as has been remarked by MR. COPE, is due to the leaf's obtaining the share of nourishment which in other varieties is diverted to the fruit. The leaves of the "Shah tut" (not the Punjabi "Shah tut," but the large crimson fruitbearing English mulberry) are said to be bitter, and almost useless for silk worms, though many of us in our younger days have fed a few upon them. The other three kinds (the small black, white and purple, fruit, bearing "Siyah tut," "Chitta tut," and "Bara tut.") are all equally valueable I believe, but inferior to "khassee." In Kotihar, the south eastern part of the valley, I saw a plantation of grafted purple mulberries, the leaves of which were very fine. It had orginally been planted for fruit, there was no lack of trees for leaves in the neighbourhood, but the owner told me that he found silk worms benfitted much by a few feeds from these grafted trees just before spinning. When the worms are young he thought these leaves would be too strong

for them, but he had evidently never made experiments with any care. Probably the worms would be strong enough to thrive on the grafted leaf after their first casting, and up to that period they would consume but a small amount of food. As the leaf of the grafted tree is more substantial and apparently more nourishing than that of the ungrafted, it will perhaps become the most important.

I imagine the small "khassee" would be the description selected for grafting on well grown seedlings, as that would add the peculiar virtue of the "khassee" to the benefit of grafting.

Travellers' works on Kashmír, state, that the best silk is raised in the pergunah Kotihar, and I was desirous of ascertaining the reasons: but I could not discover any difference, as far as appearance went, between the cocoons produced there and those of other places, and the general opinion seemed to be that Kotihar silk was no better in quality than that raised elsewhere; no other pergunah however produces so large a quantity. The three adjacent pergunahs on the right bank of the Jhilam, separated from Kotihar by Martund, are the other principal localities for silk; but it is produced more or less in most parts of the valley.

I understood that 100 maunds was considered a very large out-turn, but that must be below the capabilities of the valley, if all the available mulberry trees were turned to account. Under the depressing revenue system pursued by the Government, it would be strange if the cultivation did not languish; indeed its existence at all, considering the difficulties it has to struggle with, gives one a great idea of its vitality, when once fairly established. The Maharaja (who, however, cannot be considered to blame for the system which has been long in vogue) is the sole master, raiser, and manufacturer. He has a Darogha to superintend the silk operations throughout the valley, to whom is known the quantity produced.

701.—[ ]. Silk, from Shahpúr, reared by Dr. Henderson, Civil Surgeon.

In February 1864, an experiment on a small scale, was commenced at Shahpúr under rather unfavorable circumstances, owing to the paucity of mulberry trees in the station, and the necessity of bringing leaves from a distance, and paying highly for them.

The result of the experiment shows how very profitable silk culture will be in the Punjab in more suitable localities than Shahpúr. During half the time the experiment was going on I was absent from the station on duty. The worms were all along attended to by coolies who collected the mulberry leaves, many who had never before even seen silkworms.

Two tolahs of eggs were obtained on 10th February from Amritsar, and on the 1st of March, 15 tolahs more came from Peshawur, which were hatched in successive portions artificially; up to March 12th the hatching was effected as usual by putting the eggs in a flannel bag and getting a man to carry them close to his chest for about 70 hours. Putting the eggs below a hen might succeed.

On the 22nd March, the worms consumed 6 seers of leaves a day, and one coolie was sufficient to attend on them. On the 24th an extra man had to be entertained. On April 6th, five men had hard work to bring enough leaves; and before the first cocoon was commenced on April 12th, nine men were employed. On the 17th April most of the worms were ready to spin, or had completed their cocoons, and by the 1st May, there were 78 lbs. of dried cocoons and 10 lbs. not dried, but kept to give eggs. The greatest space occupied by the worms was 800 square feet, but they were crowded.

Two weavers were sent to Gujranwalla to learn to reel, they returned and commenced operations in June. At first they made very coarse silk, but the last seer reeled fetched 18 Rs. at Múltán. The following is a statement of the actual cost of the experiment.

Cost of 17 tolahs of eggs, ...	5	0	0
Coolies for collecting leaves and attending the worms, at 5 Rs. per mensem, ...	39	0	0
Leaves purchased, ...	9	0	0
Two weavers sent for a month to Gujranwalla, ...	12	0	0
Iron pan used in reeling, ...	5	0	0
Reeling apparatus, ...	1	8	0
Cost of reeling, being the wages of two reelers, at Rs. 6 a month,...	25	0	0
Total Rs., ...	96	8	0

The proceeds of the experiment were—

16 lbs. of reeled silk, sold at Múltán,	117	0	0
35 tolahs of eggs, valued at ...	8	0	0
Value of iron pan and reel, ...	4	12	0
Total Rs.,	129	12	0

The actual profit was Rs. 33-4, but had there been no need of purchasing reeling apparatus and leaves, then Rs. 40-8 might be deducted, being a nett cost of Rs. 56, and a profit of Rs. 73-12.

These 35 tolahs of eggs obtained were divided into three portions: one was sent up to Sakesar, 5000 feet; one was sent to a lower locality, called Sodhi valley; and the third was put in an earthen jar, covered with paper, and kept in a bath-room at Shahpúr; the two former portions were spoiled during the rains, but the third portion being kept in the cool-

est part of the house, were found in February 1865 to be in good condition, and are now being reared at Saihwál.*

The climate of the Salt range is much milder than that of the plains, and wild mulberry trees are abundant; also there is a wild species of silk worm indigenous, which feeds on the camel thorn (*Alhagi maurorum*).

The following observations on the silk at Shahpúr may be found interesting. About one-fourth of the worms were black, and all the rest white. Three days before commencing to spin, the average length of each worm was 3 inches. One hundred of the largest black worms then weighed 8 ounces and 360 grains, or about 42 grains each: the cocoons they produced weighed 6 ounces and 220 grains, and these yielded 30 grains less than an ounce of eggs.

One hundred of the largest white worms selected at the same time, weighed 10 ounces and 420 grains, or about 52 grains each. They gave of cocoons 7 oz. and 220 grains, and gave 1 ounce and 70 grains of eggs. 4 lbs. of the best cocoons produced by black worms, gave 250 grains less than 7 ounces of eggs; 4 lbs. of white worm's cocoons give 160 grains less than 11 oz. of eggs; 18 lbs. of average cocoons yield nearly 4⅝ lbs. reeled silk.

702.—[ ]. Silk, from Gugaira. Mr. Peake.

The following is an account of the experiment at this station in 1863:—

Five tolahs of eggs were received from Peshawur in a closed tin case. The box was opened about the 8th of March, and the hatching was found to have commenced. The young worms were first fed on tender leaves, and then gradually as they grew in size and strength, allowed small sprigs and larger branches.

Two rooms were used, one 10 × 14 × 11 feet in size, the windows were allowed to be kept open till the second week in April when they were closed during the heat of the day. Charpoys were employed to form terraces or shelves upon; they were placed in an inclined position. Across these beds strings were carried 2 feet apart, and the same distance above the bed, the stems of the branches rested on the beds and the tops on the cross strings.

The advantages of the plan were three-fold. I. The air circulated freely from all sides of the branches. II. The excrements dropped on the bed and rolled down, and were thus easily swept away twice a day. III. The branches were replenished with ease as well as removed, without disturbing the worms in the least. It was amusing to observe how quickly they moved on to the fresh branches so soon as they were laid on.

The room was on the south-east corner of the house, where light and air could be freely admitted. The temperature averaged about 75, extremes being 62 and 80, degrees.

The second room was on a second floor with a door and two windows; the temperature was two degrees higher, and a greater amount of light and air was available.

The maximum quantity of leaves, I think, never amounted to more than three loads per day for each room. This was supplied from trees growing in gardens and those on the road side.

The mulberry leaves used were of the white kind (*Morus alba*) only. These trees grow very luxuriantly at this station.

The first cocoon appeared on the 35th day, but they began to increase in number preceptibly about the 42nd day, and on the 52nd day they were gathered. The worms appeared healthy throughout the time occupied in the formation of the cocoons.

As soon as the cocoons began to appear, light bundles of brushwood were placed on the four sides of the charpoys, which was quickly occupied; very soon after the worms began to spin, and from forty-six to forty-eight hours the cocoons were quite formed.

Of the remaining one-third of the eggs, the hatching was not attended to for ten days, the eggs being kept in the tin box, yet they succeeded pretty fairly, only a few of the worms having died.

From 2,250 cocoons 35 tolahs of eggs were produced. The total yield of the two places was as follows:—

Rooms.	Eggs.	Cocoons in number.	Cocoons in weight.
	Tolahs.		Tolahs.
I.	9¾	3,587	574
II.	3¼	6,122	950
Total,	5	9,709	1,524

The various colors of the above bore the following proportions:—

Rooms.	Yellow.	Straw.	White.	Total.
I.	850	550	2,187	3,587
II.	1,701	1,223	3,198	6,122
Total,	2,561	1,773	5,385	9,709

Mr. Cope pronounced the cocoons very good.

* A native of Saihwál has planted out several hundreds of mulberry trees along a canal which passes though his fields, and is endeavouring to cultivate silk on a large scale.

shall here quote from his letter:—"All I can say of the cocoons is that they are *remarkably fine*, and if you can rear any quantity of the same quality, the credit of Gugaira as a silk-rearing locality would be at a very high figure.

There are about 600 mulberry trees in this station. The area of alluvial land which is available for the cultivation of these trees is extensive, and if the Civil station is eventually removed to Sahiewal, this place would make a capital locality for sericiculture, and the abandoned buildings would afford good breeding quarters, and the gardens any amount of leaves. I have ordered a rood or more to be planted with cuttings at every well.

703.—[ ]. Japanese cocoons. Dr. Henderson.

These cocoons are from Japan eggs, they are white in color, *very* much smaller then the ordinary cocoons, and are of a peculiar shape, being somewhat depressed in the middle like a figure 8, loosely drawn.

The silk is of excellent quality, but the fact that ought to bring the Japanese worms into notice is, that they will produce cocoons *five times* in the year.

WOOL.*

Scarcely inferior in importance to the silk just noticed, ranks the class of wools. This includes the beautiful pashms of Changthán and Turfán, and the soft white fleeces of Kirmán. This class will be found to embrace three distinct kinds of wool, distinguished not only by the climate and soil where they are produced, but also by the fact that they are the produce of different animals.

These classes are — 1st. The genuine pashms of Changthán, Turfán, &c., which are monopolized by Kashmír;* and those second class pashms, the produce of Rodokh, Ladákh, and even Spiti and Rampúr Bashahr, which form the staple export to the shawl manufactoring cities of the Punjab, Amritsar, Ludhiana, Jelálpúr, Nurpúr. Included by analogy of locality only, are the wools of the Ibex, so rarely seen, and the Yák, the thick tails of which animals are prized for chauries (fly flaps).

2nd. The wools produced beyond the N. W. Frontier including those of Peshawur.

In this division comes;—the Dumba sheep wool, the wools of Kábul, Bukhára, and that imported from Kirmán; in fact all classes of wool, produced on or beyond the N. W. Frontier. The trade in these wools is now extensive, both by the Peshawur and other routes in the N. W. Frontier. There is also a very considerable export to Karáchi and Bombay. It is a remark of Burnes, "that our early commercial connection with the countries on the Indus was sought in order to find vent for British woollens, while the existing trade was almost confined to cottons; and this is the more singular as there is good reason to believe that in return for those cottons we shall shortly receive raw wool from the countries of the

* In this country wool deteriorates immediately on commencement of the rainy season, unless very carefully watched. Pashmina and pashmina fabrics are as quickly destroyed and need exposure to the sun and air, whenever during the rainy season an opportunity offers. Samples of raw wool are soon eaten up: the fibre does not disappear, but remains *in situ*, looking of a pale color like an ash till it is touched, when it all collapses into dust. Pashmina is especially liable to this fate; there are several insects which eat the wool, but the most formidable is a blackish apterous insect, about one-fourth of an inch or less in length, of an oval shape, with small head and legs, an oval body divided into segments by abdominal rings, from the edges of each of which strong black hairs project like a fringe. A number of specimens in the Lahore Museum have suffered in this way. The boxes that contained the wools were found on being opened only to contain a little dust like ashes, as if the wool had been burnt, and a quantity of the dead carcases of the insects, which had eaten it up, and died within the wooden prison, from which they could not escape. I have attempted recently to preserve wool in glass bottles, by treating it first with a solution of corrosive sublimate and camphor, and then drying in the sun.—B. P.

* The interests of the Maharaja of Kashmir and his manufacturers are identified in the endeavour to retain the monopoly of the shawl wool; consequently, none of the Turfáni wool from Yarkand, which is the finest, is allowed to pass into British territory; we are entirely supplied from Changthan.

It is probable that, on the whole, the demand for shawl wool has of late years much increased. Native accounts represent that the use of the Turfáni wool has arisen within the last quarter of a century.

It is evidently of the highest importance that the supply of the raw material of the exquisite shawl manufacture, peculiar to Kashmir and the Punjab, should be effectually facilitated and protected. There is no doubt that it is inexhaustible; and it is impossible not to admire the felicitous conjunction, in the same region, of a natural product so valuable and of workmen so artistic.

Indus." This anticipation has now been completely fulfilled.

The 3rd division includes the produce in wool of the districts of the Punjab. With the single exception of the Merino sheep introduced into Hazara, the wools are almost entirely the produce of the sheep (black and white), or the goat. To these must be added the wool of the camel in the "thal" and "bar," of waste districts such as Shahpúr, Gugaira, and others.

Wool being generally, in the Punjab at least, produced without artifice or skill, there is but little to be said as to the origin and progress of its cultivation. The different kinds of wool are, and have been, localized for ages; the attempts to improve and cross different breeds, have been few and insignificant; and there seems hitherto to have been no desire among the natives, who rest abundantly satisfied with the breeds that exist, and neither know nor appreciate the benefits of improvement.

Whatever has been done, such as the attempted introduction of Merino wool into Hazárá,* or the production of pashm in Spiti, is due to European endeavours.

Much remains to be done in improving and extending the produce, and still more, in introducing good methods of cleaning, dressing and working up the wool. On this subject in 1863, MR. MACLEOD wrote as follows:†—

"On the plains of the Punjab, I believe that there is a fine field for the application of European capital and skill to the production of superior varieties of wool. And I think it highly probable, that the merino sheep, or at all events half breds, would thrive well if properly cared for. Large extents of grazing lands can be secured in many parts,—the climate, though hot and trying to the European constitution, is dry and not unhealthy,—and I believe that there are gentlemen in the Punjab, well suited for the charge of an experimental sheep farm, if Government should think it worth while to establish one; as I have remarked on a former occasion, I believe the climate of the Salt range, where the Dumba or fat-tailed sheep, is apparently indigenous, to be the best suited of all for the purpose, but the extent of grazing land there is limited."

* The Hazara experiment, must I fear be pronounced a failure, it has gone on for some time past always dying a slow death, although not yet extinct. The people it is said do not want and could not use the fine merino wool.—B. P.

† (Revenue Report, 1862-63, p. 99).

It is almost impossible to estimate the external trade of the Punjab in wool, nor are there any statistics from which the quantity supplied to foreign countries can easily be ascertained. The trade in wool to Great Britain has wonderfully increased: it originated no further back than 1833, with the insignificant quantity of 3,721 lbs (all India), in 1858 the quantity had risen to 17,383,507 lbs! and this is probably very much under the present rate of exports.*

Under the microscope wool exhibits a structure consisting of a series of serrated rings, imbricated one into another, like the joints of an *Equisetum*. The filaments of the fine qualities, writes PROFESSOR BRANDE, are varied in thickness from $\frac{1}{1100}$ to $\frac{1}{1500}$ of an inch. Wool possesses, unlike silk and cotton, the remarkable property of *felting*, *i. e.*, its fibres adhere together forming a compact mass. Felt hats are manufactured by simply taking advantage of this *felting* property, the fibres being pressed together; this property is known to natives, who manufacture extensively a "namda," or thick felt. This felting property exists in greater extent in most of the hard coarse wools. If requisite the property can be destroyed by passing the fibre over heated metal combs, which process destroys the laminæ of the fibres.†

Wool naturally contains in its pores a sort of potash soap, called yolk, secreted by the animal: to this is owing the lather that wool gives when rubbed up in warm water, the

* In DR. FORBES' Catalogue, the following figures appear as the total exports, from India to all parts of the world. The United kingdom receives by far the largest share.

1858-59	the exports were	15,688,196 lbs.
1859-60	„	19,562,897 „
1860-61	„	21,382,405 „

† See "Philosophy of Manufactures, p. 91. 2nd Ed.

"yolk" is especially abundant in the wool of the merino sheep.

It has been observed that the nature of the soil on which the sheep and goats are fed has most influence on the texture and quality of their wool.

Sheep whose pasture grows on calcareous poor soil have short harsh wool, while those on rich loamy argillaceous soils, have longer and softer hair. The influence of the temperature and the atmosphere is also no doubt considerable.

The same animal produces different kinds of wool. On a sheep the finest wool is on the spine from the neck to near the tail, including one third of the breadth of the back. The second kind of wool covers the thighs and shoulders, the third clothes the neck and rump, and the fourth on the lower part of the neck and breast down to the feet; and also upon a part of the shoulders, head, and thighs, to the bottom of the hind quarter.

There is also a very marked difference in the kind of wool yielded by the pashm goat.

Camel's hair is of two qualities; the under or soft wool is that which is in use for manufacturing chogas.

HILL WOOLS AND PASHM.*

Pashm is a downy substance growing next the skin and under the thick hair of the Thibetan goat: it is of three colors, white, drab and dark gray, or "túsha." The best kind is monopolized by Kashmír, and is the product of Turfán and the provinces of Chinese Tartary. The Punjab is supplied from Changthán, whence the wool is exported by Leh to Amritsar, and the other shawl weaving cities of the Punjab. Rámpúr, is a great mart for the reception and forwarding of wool. The prices usually are Rs. 3 or 4 a seer of uncleaned, and Rs. 6 to 7 a seer of cleaned pashm:—"túsha" wool sells at Rs. 2 to 3 a seer, and if cleaned Rs. 5 to 7 per seer.

Pashm is the chief article of trade in Khuttan and Ladákh. It is cut once a year; the wool picked out is sent to Kashmír, but the hair is made into ropes, coarse sacks and blankets. After the hair of the goat has been cut short with a knife in the direction of its growth, or from the head towards the tail, a sort of comb is passed in the reverse direction and brings away the finer wool almost unmixed with the coarse hair. If not shorn as the summer commences, the animals themselves rub off the wool.

Moorcroft (Vol. II., p. 347) mentions that, "by ancient custom and engagements, the export of the wool is exclusively confined to Kashmír, and all attempts to convey it to other countries are punished by confiscation. In like manner it is considered illegal in Rodokh and Changthán to allow a trade in shawl wool except through Ladákh; and in the latter country considerable impediments are opposed to the traffic in wool from Yarkand, although it is of superior quality and cheapness;" but in these days a good deal of shawl wool is brought by different paths on sheep to Rámpúr, and sent from thence to the Kashmír colonies in the Punjab.

The goats are found domesticated all over the mountainous country of western Thibet, particularly in the provinces of Ladákh, Rodokh and Garo. Changthán is the name given to the elevated plateaux, where innumerable flocks are pastured.

704.—[5536]. Pashm wool from Bashahr. Raja of Bashahr.
Simla.

705.—[5537]. Goats' hair. Bashahr.

Rampúr, of Bashahr, besides being productive of sheep and other wool in itself, is the great market for the Changthán wool. Its trade and exports are noticed further on.

706.—[5560-64]. Series of shaw wools; cleaned and uncleaned.
Spiti.

They are of a whitish gray color. The wool has

* Extract from Mr. Davies' Report on the trade and resources of the countries of the N. W. Boundary of British India.

been twisted into a loose kind of rope, and the rope again made up into a long thick roll or coil, in this state it is usually sold or bartered to the traders.

The district of Spiti, geographically part of Ladákh, was purposely annexed to the British territory in 1846-47, in order to prevent the interposition of a foreign state between Rampúr and the shawl-wool districts of Changthán.

The shawl goat thrives in Spiti, though the wool is not reckoned equal to that of Changthán. The Maharaja was in 1847 excused from rendering shawl-goats under the stipulation of the treaty, in consequence of the animals dying at Dhurmsala, where they were kept. It is apprehended that sufficient pasturage for any large number could not be found in Spiti.

707.—[ ]. Series of pashm. From Lahore. LAHORE MUSEUM.

White pashm, uncleaned, from Kashmír.

White pashm, cleaned: value Rs. 8 a seer.

White thread spun at Lahore: value Rs. 16 a seer.

Another thread: value Rs. 12-10 a seer.

708.—[ ]. *a.* Brown pashm, "pashm khud rang." GHULAM NABI. From the Motí bazar, Lahore.

b. White pashm, ditto.

c. 2nd quality pashm, ditto.

d. 3rd coarse quality pashm, ditto.

e. Thread of coarser pashm: value Rs. 8 a seer.

f. Thread of Túsha pashm: value Rs. 4 a seer.

The pashm that comes to the Punjab comes from Changthán; there are two qualities, one "khalchak" (superior) and "ralchak" (inferior). The export from Changthán is about 700 maunds, which sells at Lé for from Rs. 60,000 to 70,000.

The MAHARAJAH OF KASHMIR keeps a monopoly of this wool as he does of Turfáni wool,—at least of the quantity annually exported from Changthán to Lé. The whole of it is taken to Kashmír, Balti, Kashtwár Doda, and Bhadrawa, in the MAHARAJA'S territory. The inferior stuff only is taken to Balti; The Punjab shawl-weaving towns are supplied with Changthán shawl wool (the only wool they have as yet been able to secure for themselves) from Rampúr. The merchants of this place bring down large quantities from Ghar-garo, or Gurdokh, in Changthán, where a large commercial fair is held annually in August (Bhadon). The Lahaul traders bring Changthán wool through Ladákh.

Kashmír. The Kashmír collection (5609-5692) (5700-5711) presented an extensive and interesting series of the varieties of wool, and of the various places of production.

709.—[5683]. Shawl wool, from Káshghar.

White wool, from Changthán.

White wool, from Turfán.

Black wool, from do.

"Túshí" wool, from do.

"Kamál" wool, from Changthán-Kamal.

"Kalchak," wool, from Kalzak.

710.—[5770]. Kháshghár pashm (quality inferior to the first series).

Changtháni wool, with a sample of black wool.

Pashm, from Kamál, Ladákh, and China.

Coarse wools, from "Kashmír and Kalzak."

The following particulars regarding pashmina, are extracted from a paper in the Proceedings of the Agri-Horticultural Society of the Punjab, entitled, *A rough Sketch of the article called Pam or Pashm; the different varieties, places of production, and of the manufacture into Shawls, forwarded by* F. H. COOPER, ESQ., C.B.

Wool of the first quality.—This is termed "shahtúsh," and is produced in the Mongole and Khalkass ranges. It is the inner winter coat or fine downy wool of a small species of wild goat, there called "thosh;" and is valued highly in those regions, on account of its supposed limited production and high price, as well as its absorption and perhaps monopoly, not only by the native chiefs where produced, but by the magnates of Russian Siberia, who prize it highly for some medicinal properties, which it is supposed to possess. It is very scarce, and only brought down to Kashmir occasionally, and in very limited quantities, mostly in small round balls of fine spun thread, and very rarely as raw wool. Consequently, at Kashmír, it is not a marketable article, and not found in commerce. But people of wealth in Kashmír, at whose request it is thus occasionally brought down by the

Argouns, have it usually made for private use into plain shawls without any work, called sádhá chádhur, from 4 to 6 yards in length, and 1 to 1½ in breadth, or into stockings, gloves, caps, and undervests, &c. It is of a fine soft white color, but its price altogether depends upon fancy. Plain shawls, or sadha safed chádurs of shah túsh, are known to have been purchased at Kashmír, at from 80 to 180 to 200 rupees.

2nd.—This material is the same as the first in every respect, with the exception that its natural color is gray, it is called khudráng tush, or "tush of its own color," to distinguish it from the above or white variety, called shah túsh; and although preference is usually given on account of the white color to No. 1, still the difference in the estimation or value of either, is considered but a mere matter of fancy.

3rd.—This is the much famed Túrfáni pashm of Kashmír commerce, and shawl manufacture. It is the production of the Túrfán Aksu, Kamal, and other hill districts, ranges east and north-east of Yarkand: it forms the inner wintry coat of the domesticated goat. It is brought down by the Argouns to Kashmir *viâ* Yarkand, in the form of coarse or uncleaned pam or pashm, mixed with the outer hair of the goat in various proportions, but separated at Yarkand or Ladákh from the Túrfání Khudráng pam, or colored variety. This white but coarse Túrfáni pam is sold in the Kashmir market, according to the quantity of hair or impurities it may contain, at from 8 to 12 and 14 rupees weight for the Chilkee rupee of ten annas; but when cleaned and spun, it produces from 4 to 5 rupees weight of thread, or tár-i-pam, which sells according to the fineness of the thread, at from half a rupee weight to 2½ rupees weight for one rupee Chilkee—while the value of the shawls, according to the manufacture, may vary from 70 to 5,000 rupees. This pam contains no scurf, dander, or scales from the skin of the animal, which allows of its being easily cleansed.

4th.—This is the Changtháni wool and most common in the market; it is the produce of the domesticated goat of the Changthán province, and may be said to be produced along the northern base of the ranges, from about Rodokh in the west, or even from the banks of the Shegak, eastward to the *Kailás* ranges, north of *Mán-Thaloi*, or Mansarowar lakes; and even it is said as far as *Lhass-Laass* (Anglicé Lhassa). This wool is brought to Kashmír *viâ* Leh or Ladákh, not only by the Argouns but also by numerous other traders; on account of the quantity of hair mixed with it, as well as the scurf or dander which it invariably contains, it sells at from 10 to 16 rupees weight for one rupee Chilkee. It produces also from 4 to 5 rupees weight of tár or thread, which sells at the same rate as that of the former, or No. 3 quality. A rupee's value of either pam in the coarse state, produces the same quantity of tár or thread. The "tár-farosh," or thread-dealer, after he has made his purchases, then separates the Túrfáni from the Changtháni thread: this he easily discriminates by the practised touch of his hand, which enables him afterwards to sell either, or both, to the shawl weavers to advantage, according to the market rate. The shawls made entirely of this pam, are not usually manufactured into such costly articles as those of the Túrfáni wool, but it is the usual practice to make use of both in the manufacture of all shawls, at present, so that their price or value becomes thus equalized.

5th.—This is the article, called *Túrfáni tús*, as also *khudrang* pam, or naturally colored wool. The Túrfáni and Changthani coarse khudráng wools are usually mixed and sold together, at from 12 to 18 rupees weight for one rupee Chilkee, which produces from 5 to 6½ rupees weight of thread which sells according also to the fineness, at from three-quarters of the rupee weight to 3¼ ditto for one rupee Chilkee. This is usually made into plain shawls, or sadha chádhur, the usual price of which range from 35 and 40 to 80 rupees.

6th.—This is quite a different article from any of the foregoing, its only title to be classed here is its carrying the name of pam with it. It is derived from the water-fowl, as under the name of *brej* or *bregr pam*, an article which occasionally comes down from *Siberia* (Seebere, Seetha, or Seeth, by the natives) (Scythia?), usually as a lining to *postins*, caps, stockings, gloves, neckties, &c., from its nature it cannot be spun into thread; it is of a white color, with a certain gloss, and supposed to be a species of eider down—it is fancy priced.

Miscellaneous Remarks—All, or most of the mammalia of the above named countries, and other similarly situated localities at an elevation of 11 to 13 and 14,000 feet, which are consequently subject to severe winters, and a high rarity of atmosphere, whether domesticated or wild, such as the dog, yák, or kárhgan, &c., &c., possess a wintry inner coat of pam, of different degrees of fineness. The pashm of the goat is alone the marketable commodity; besides this the hair of the yâk and Kirghiz camel is in parts cropped: and both in a cleaned and coarse state are made into cloth of different degrees of fineness for Khirghiz (nomadic) tents, clothing, bedding, saddle bags, ropes, &c., &c. The hair picked from the marketable pam at Kashmír, constitutes a different branch of manufacture of ropes, saddle bags, and hair cloth of different kinds, qualities, and uses. The Argouns are Mahomedan Kashmir emigrants, or the descendants of such who have settled in Ladákh, Yarkand, Chángthan, or in any part of Chinese Tar-

tary, for policy and security : they usually have establishments with agencies at the principal towns and cities they frequent and trade with. Thus, the Argoun of Ladákh, besides his original or primary establishment at Ladákh, has another at Yarkand, and also perhaps according to his means or extent of trade, at Aksu, Ilchi, Túrfán, &c. ; while the *Argouns* of Yarkand, as also the Khojas of Andejan, are known to have establishments in many towns and cities of Russian Siberia. In Chángthan, at the Arghils cattle sheds, and Yaitaaks pasture grounds, the usual price of the raw article or coarse pam is about 2 vuttees (4 seers pucka, or 8 lbs. English) for Rs. 3, or about 6 annas the lb. weight, and tobacco is bartered for about double its weight of coarse Changthan pam. So also green and red dyed goat skins of Punjab manufacture, with shoes, and boots of the same article (the latter made in Turki fashion) are bartered at Yarkand, Aksu, Ilchi, Túrfán, &c., for treble and quadruple their weight of raw pam. In the same manner not many years since, the glass beads and buttons of Birmingham were wont to be bartered for an equal weight of gold dust, or regh-i-zar throughout the entire country of Ghilghit, Yarkand, Mazzhuji, Chitral, and along the south base of the Múz Thaugh, and Khara Khúram.

Even now Russian iron-ware, pots, pans, brass buttons, trinkets, gaudy colored silk handkerchiefs, &c., find a free barter traffic north of the Khara Khúram, among the Pamir Khirghiz, and round the different sources of the Amúr or Oxus. The raw or coarse pam is cleaned or prepared for spinning by women, girls, and boys. The picking and separating the hair from the pam is the first process, after which it undergoes a regular series of manipulations, with fine damp rice flour made by steeping the rice two or three days, and afterwards pounding or grinding it in a moist state on a stone slab, or in a shallow wooden vessel, called *pruathera*, with a stone pestle. When thus properly cleaned, the pam is put into a clean earthen vessel and thence taken in small quantities of a few grains weight at a time for the purpose of undergoing a process called *túmba*. The operation called túmba consists in opening out and separating the fibres, removing knots, clots, impurities, &c., with the fingers and thumb of both hands, during which process, the pam dries and lets fall all the rice flour : when this process has been repeated several times the pam becomes ready for spinning by females, young and old. They again sell the thread to the tár-farosh, or thread dealer, who, as I have mentioned, separates the Thúrfání from the Chángthan thread, and sells it as required to the shawl báfs or shawl weavers.

The shawl báfs, according to their means, keep up an establishment of from three to four hundred *shagirds*, or apprentices, of children from five years of age, to old men and women of eighty. The shawl báf pays to Government a capitation tax of from 16 and 18 to 50 rupees per annum, for each shagird that he employs.

When the shawls are made, they are brought to the Government Superintendent of the shawl manufactory, or Head Contractor of such, and by his orders the shawl undergoes a certain examination and form of valuation, the result being that the shawl is stamped (shawl-dágh) according to its real or supposed full value, and a stamp duty is there and then levied upon the shawl, of from 50 to 60 per cent. of the full valuation. Besides this, *presents* have to be given, and are expected on all these and other occasions—such as births, marriages, &c., by not only the Head Superintendent or Shawl Dágh Contractor, but by all his minions from the highest to the lowest. The climax to such matters does not arrive, until the Head Superintendent, for some cause or other, is pleased to feel disapprobation with the shawl báf, when most, perhaps all, of his apt and able work-establishment or shagirds are abruptly removed and placed under the charge and care of a more lucky master weaver ; and in lieu of them the unfortunate shawl báf gets a number of incompetent shagirds who are almost useless.

The Argoun merchants and traders of Ladákh and Changthan have made it a point, from time immemorial, to advance large sums of money for the purchase of pam throughout the different districts of the pam producing provinces. But they wisely place their money in the hands of the authorities and chiefs, both secular and religious, of those provinces, and propitiate with yearly presents not only these provincial *Lhamas*, and other dignitaries, but also the great *Lhamah* of Lhass himself. They thus obtain not only full security for their money, but also secure a permanent yearly supply of the shawl wool, and thus, in turn all or most of those Argouns, have been cleverly induced for many years past, to trade solely with Kashmír, *viâ* Ladákh, in preference to other marts.

It is only for the last 20 years that the Turfání and Kucharí shawl wool has been exported into Kashmír from Yarkand. Before that period, the Changthání wool alone was used in Kashmír. The Ladákhies would never clean the wool from the pieces of skin and coarse hair found in it in its raw state. The Kashmíris, after the conquest of Ladákh by the Dogras, succeeded in cleaning it by first steeping it in lime water. The process now performed by the Turfánis and others who are thus able to export good stuff free from dirt, coarse hair, &c.

711.—[5562] Bukhárá Pashm. Local Committee, Peshawur.

This is produced at from Rs. 1-8 to 4 a seer; it is imported into Peshawur to the value of Rs. 40,000 yearly: it is a superior wool, though inferior to that of Thibet.

712.—[5559], Antelope wool. Lahaul. Tara Chand.

Called "tsodkyi-lena," (or properly bRtsodkyi-lena. Thibetán,) and is very precious.

713.—[ ]. Ibex hair, being the wool of the teringole, or ibex. P. Egerton, Esq.

This is the wool that makes the famous and rare ibex shawls; the animal is also called "kin."

HILL WOOLS OTHER THAN SHAWL WOOL.

Simla. **714.**—[5532-33]. Wool from Bhaji and Bhagal, by the Ranas.

715.—[5534]. Black wool. Balsan. Rana of Balsan.

716.—[5541]. Wool, from Chumúrtí. Mr. G. Jephson.

Mr. Jephson also exhibited a sample of ordinary Simla hill wool (5542).

Kangra. **717.**—[5545-46]. Sheep wool, second quality.

718.—[5447]. Species of Kúlú sheep wool, from Kothi múlí. Local Exhibition Committee.

719.—[5448]. Goats' hair. Kangra district.

Lahaul. **720.**—[5555]. Sheeps' wool, black and white. Lahaul. Tara Chand.

Called "luggi-bal;" it sells at present for 6 kutcha seers per rupee, but a few years ago it was 7; the demand has much increased: it is exported to Kúllú and Kanáwar.

721.—[3536]. Yaks' wool. Rupshu and Zangskar. Tara Chand.

Called "Kúllú": the soft under hair of the yâk, used to make bags for sheep loads, and the felt soles of shoes.

722.—[5557]. Sheeps' wool. Changthán. Tara Chand.

Value 3 seers per 1 rupee.

723.—[5550]. Goats' wool. Changthán. Tara Chand.

Called "ramai lena." Value 2 pakka seers for Rs. 4, 5, and 7, according to circumstances.

Spiti. **724.**—[3565]. Wild sheeps' wool. P. Egerton, Esq.

The wool of a wild sheep killed at Spiti by Mr. Egerton.

725.—[5566-7-8]. Sheeps' wool, of three qualities, Tehsildar of Spiti.

The following passage descriptive of sheep in Spiti, is taken from Mr. Davies' report.

"The mountain paths between Rampúr and Spiti are so precipitious that sheep, more sure-footed than larger beasts, are commonly used to carry burthens of from 16 to 20 lbs. The sheep are driven from village to village with the wool on, and as the required quantity is cut from their backs, they are laden with the grain which is received in exchange, and which when the fleece is all disposed of, is carried into Chinese Tartary, and sold at a profitable rate. It is the custom for the shepherds of Chumurti to give an order while the crops are yet green and on the ground, for any amount of grain they may require, which, when the crop is ripe is stored up by the cultivator until the summer of the ensuing year: when the shepherd arrives with his flock, he gives the wool in exchange and receives his grain, which he puts into small bags, and drives back his flock thus laden."

726.—[5570-71]. Sheeps' wool, cleaned and uncleaned. Nono of Kuljang, Spiti.

This wool was sent to compete for the prize for the best wool in the Punjab. The sheep are shorn only once a year.

The sheep appear to be of two distinct breeds. The common one produce the fine Bhíoanghi wool, and the other is a very large species, which is brought from Chumúrtí with very long wool, but not so fine as the other.

The goat is the description which produces the shawl wool or pashms.

The total number of sheep and goats in this place is 1095.

727.—[ ]. Sheeps' wool, from Rámpúr Bashahr. Mr. Stephen Berkeley.

About 2000 maunds of wool are annually brought to Rámpúr, and about half that quantity of pashm. The price of the wool averages about 4 lbs. for the rupee, and pashm Rs. 2-4 for 2 lbs.

Washing the wool is a very tedious process. It is spread on to a plank which is slightly sloped, hot water is then poured on the wool, which is at the same time beaten with a flat stick. Care is taken not to entangle the fibres of the wool; which, when clean, is spread out to dry. It is absolutely necessary to wash wool on a sunny day, or it is likely to get entangled if left wet for a long time.

728.—[5573]. A series of yaks' tails, used for chauries. Spiti. LOCAL COMMITTEE, KANGRA.

The following is CAPT. HAY'S account of the yâks at Spiti. I give the passage entire, as it contains a notice of the other domestic animals of that remote region.

"These animals consist of yáks, jubboos or half yâks, cows, "ghoonts," asses, sheep, goats, dogs, and cats.

"The yák is a highly useful animal—with it the people plough, and carry loads, it furnishes also milk, and hair to make ropes.

"In the severest weather this animal appears to enjoy itself in the snow, and is often to be seen with icicles of several inches in length hanging to its nose, and a foot or more of ice hanging to the hair which falls from its neck and shoulders. Long hairs hang over the eyes and prevent their freezing. The total number of yâks in Spiti is 439, and of jubboos and cows, 412.

"The numbers of asses 79. They are strong, but of a small breed, they principally carry fire-wood, and their milk is drunk.

"Each village has its 3 or 4 dogs, and a very fine species of black cat.

"The ghoont, though a useful animal, seldom carries any burden but a man: the total number in Spiti is 265; they are bred chiefly for sale. They have two breeds—one a small ghoont, never above 12 hands high, peculiar to the country; and the other a large breed, from 13 to 13½ hands high, is bought from the Chinese, and usually comes from Choomoortee. For a Chinese ghoont two years old, they give a Spiti ghoont four years old. All are equally hardy and are kept out the whole winter, except the yearlings, which are housed. During winter the ghoonts live on the roots of the stunted bushes, and are very expert at scraping the snow from off them with their forefeet. The breed of ghoonts might be improved with a little care. Many are killed during winter by wolves and leopards.

729.—[5682]. Wool. Srinagar. H. H. THE MAHARAJA.
Kashmir.

730.—[5683]. Wool, from Ladákh. H. H. THE MAHARAJA.

Besides itself producing wool, there are large imports to Ladákh of wool from Rudokh, &c. From the latter place, Rs. 20,000 worth reaches Ladákh, and Rs. 30,000 worth goes to Rámpúr.

WOOLS OF THE N. W. FRONTIER.

II. We now come to the second class of wools, produced at or about Peshawur, Kábul, Kandahar, and Persia or Kirmán.

The most interesting varieties of wool are, —1st, that of the *Dumbah*, a large tailed sheep, at Peshawur and Kábul; from the latter place it obtains the name of "kábli pashm;" it is used in the manufacture of "chogas" (cloaks with sleeves) as worn by the Afghans.

2nd. Is "pat," the hair of a goat common in and about Kábul; fabrics called "pattu" are made from this.

3rd. Is Kirmání wool, a beautiful white, very soft wool, produced at Kirmán it is called "wahab sháhí."

4th. There is Kandahárí and Bukhára wool, among which we may include the Karakuli lamb skins* of Bukhára.

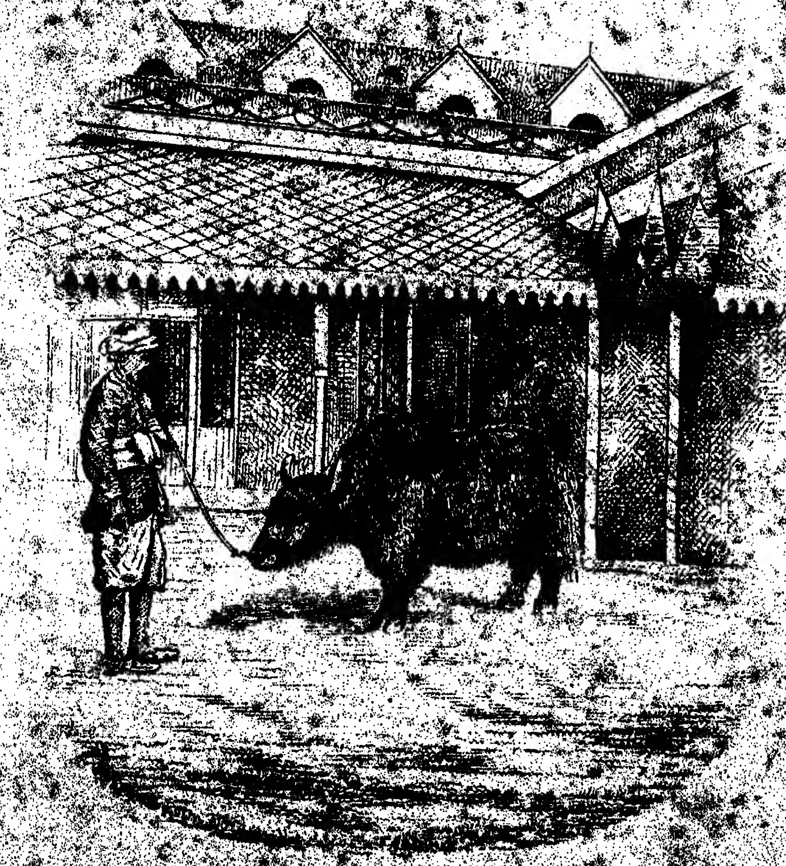
This class is represented in the Exhibition by the following:—

731.—[5595]. Wool of Dumba Sheep Peshawur valley. LAHORE MUSEUM.
Lahore.

732.—[5566]. Wool from Peshawur. LOCAL EXHIBITION COMMITTEE.
Peshawur.

Wool obtained from the fat-tailed variety of sheep is used in the manufacture of clothes and carpets, and also exported to India. It is of wide distribution; the sheep abound at Peshawur, Kábul, Kandahar, Herat, and other places: Kelat and the surrounding country produces sheep's wool in great abundance. This sheep is apparently indigenous also to the Salt range.

* The lamb skin (with the fleece on) of Karakul (a district about 20 cos distant to the south of Bukhára, is famous. About ten lacs of rupees worth of these skins, the produce of Karakul and other districts of Bukhára, (all being called "Karakul," is annually exported from Bukhára to Persia, Turkistan, Russia, Kábul and India. The greatest quantity goes to Persia, where the people make caps of "Karakul," called "papakh." A piece of the best description of "Karakul" sells from Rs. 25 to 16 in Persia.



THE YAK

The following account of the trade in these wools from Kandahár, is extracted from Col. Lumsden's Report on Kandahár.

At Birgand, Hazara, Herát and Kandahár, when advances are made to the nomads on the future crop, the price on the spot is about 12 company's annas per Kandahárí maund of 4 company's seers; but if purchased at the time of shearing it cost Rs. 1-4 for the same weight; and if taken on credit Rs. 1-8. A load of 48 maunds Kandahárí or 192 company's seers is carried to Kandahár from any of the districts above-mentioned for company's Rs. 12-8, and from this point to Kuráchí for the same sum. The reduced rate for the latter distance is accounted for by the road being better, and below Dadar, perfectly safe. The gomashta, or agent, proceeding with the investment, receives two-thirds of the profits, taking an equivalent share of risk; but if the arrangement with him is made on the Mahomedan principle (known as Mozaribat), when the agent runs no risk, one-fifth of the profit is absorbed in his pay.

The agent in Kandahar says that, the tariff of boat-hire from Karáchi to Bombay varies so much, that it is impossible to give even a fair approximation to the expenses of transit: the price in Bombay may be put down as Rs. 192 per kándi of sixty Kandahári maunds. Pure white wool is the most marketable; but brown and white are frequently mixed. The wool of Birgand and Herát is generally shorn twice a year; and if not exported, is manufactured into carpets, "bálázins," Masnadi namads, and common felts. The fine wool known as Kurak, is procured from goats in the Herát, Gazak, and Hazara districts.

733.—[ ]. Kirmani wool. Several samples were exhibited, which were not included in the Catalogue, and some of these were of great beauty.

Kirmán is a tract of country close by the Persian Gulf, to the south of Persia.

The wool finds its way into the Punjab in considerable quantities. It is a soft delicate wool, but its principal use at present unfortunately appears to be the adulteration of genuine pashm. A Table is annexed showing the imports of real pashm and Kirmáni wool into Amritsar, side by side: the increase of the latter is marked: the subject of the adulteration will be resumed when we come to speak of manufactured shawls.

Statement of Kirmání wool and real pashm imports in the city of Amritsar from 1850-51 to 1861-62.

Real Pashm.				Kirmani Wool.				Remarks.
Year in which imported.	Quantity imported.			Year in which imported.	Quantity imported.			
	MDS.	S.	CH.		MDS.	S.	CH.	
1850-51	1,300	...	...	1850-51	40	...	...	
1851-52	1,250	...	...	1851-52	100	...	...	
1852-53	900	...	...	1852-53	250	...	...	
1853-54	950	...	...	1853-54	300	...	...	
1854-55	850	...	...	1854-55	400	...	...	
1855-56	700	...	...	1855-56	400	...	...	There is no scarcity of pashm, but the agents from Amritsar no longer go up to Bishahr for it, owing to increased import of Kirmání wool. This inferior wool has put the real pashm out of the market.
1856-57	600	...	...	1856-57	500	...	...	
1857-58	600	...	...	1857-58	700	...	...	
1858-59	500	...	...	1858-59	700	...	...	
1859-60	400	...	...	1859-60	800	...	...	
1860-61	400	...	...	1860-61	1,000	...	...	
1861-62	500	...	...	1861-62	1,000	...	...	
Total, ...	8,950	...	...	Total, ...	6,190	...	...	

MR. DAVIES writes thus:* "it is evident that the quantity of shawl-goat's wool imported into Amritsar has, for several years past, decreased. In its stead, sheep's wool from Kirmán in Persia, has been largely introduced into the manufacture of shawls. This wool is fine of its kind, and long in the staple. It is much more easily and quickly worked than the more delicate goat wool. It is largely used in Persia in the fabrication of "jámewars," which have superseded the use of Kashmír shawls in that country."

WOOLS OF THE PLAINS.

III. We come to the last class, representing the wool of the plains.

Among these I have included the wools of Hazara, because they could not very well be included in any other. It is here that the first attempt at improving the breed was made, by the introduction of the merino sheep; but there does not seem any great prospect of success. Merino wool that was sent home in 1860, fetched 1*s.* 6*d.* a pound. At present, merino wool in Europe is chiefly produced—the best in Spain, the next best in Saxony. However unsuccessful the experiment may be, there are many other ways in which the breed of sheep might be improved, and the wool trade stimulated: of pasturing grounds there is no lack.

"There can be no doubt," wrote the Financial Commissioner in 1861, "that the valleys of the Sutlej, Rávi, Chenab, Nainsukh and other tributaries of the Indus supply grazing grounds, not to be surpassed in any part of the world. The population inhabiting these are chiefly pastoral, but owing to sloth and ignorance, the wool they produce is small in quantity, full of dirt, and ill cared for in every way."

The kinds produced are—

1. Black and white sheeps' wool, for blankets, &c.
2. Goats' hair, for grain bags, rope, &c., &c.
3. Camels' hair: the inner wool is used for chogahs of a common kind, and is very soft. This wool is produced in the "bar" and "thal" tracts of Shahpúr, Rohtak, Jhang, and Gugaira, which are camel feeding districts.

The collection is thus represented:—

* Report on Trade Resources of N. W. Frontier Provinces, &c.

SHEEPS' WOOL.

734.—[5521-22]. Dehli. Black and white wool. MUNICIPAL COMMITTEE.

735.—[5644]. Shahpur. Wool of the flat tailed sheep. Salt range. DEPUTY COMMISSIONER.

736.—[5648]. Common wool, from the "bár" tracts. DEPUTY COMMISSIONER.

737.—[5527]. Sheeps' wool. LIEUT.-COL. VOYLE.

Wool was also exhibited from—
Ambálah (5530 and 31).
Jálandhar (5543).
Lahore (by BADRINATH DALAL).
Gujranwalla (5632).
Gujrát (5638): value, 3 seers per rupee.
Rohtak (5527).
Gugaira (5648).
Jhang (5651).
Muzaffargarh (northern portion) (5653).
Dera Ismail Khán (5656).
Dera Ghází Khán, two samples (5658-59).
Bunnoo (5661).
In which district it is stated to be produced in large quantities, and exported to Sakkar; its value being Rs. 16 a maund.
Jhilam (5462).
Maler Kotla also exhibits black and white wool of superior quality (5518-19).

738.—[5694]. Hazara. Black wool, from Kághán. LOCAL EXHIBITION COMMITTEE.

739.—[5675]. White wool. LOCAL EXHIBITION COMMITTEE.

740.—[5676]. Half bred merino wool. Kághán.

741.—[5677]. Introduced merino wool. Abbotabad.

"In regard to wool, there is nothing new to communicate of an encouraging nature. When passing through Hazara in April, I saw the merino flock; and was greatly disappointed in it. It is under the care of a shepherd from Hindostan, who appears not at all to like the cold of the hills; and will not willingly venture into the localities best suited to the sheep. The latter appeared to me to be in a most wretched condition, offering a great contrast to the half breds reared by the Sayads of Kaghan, who confess the wool obtained from these to be much softer and finer than that of their own sheep; though they do not appear greatly to appreciate these qualities. I consider, as I have heretofore stated, that there is no prospect whatever of merino wool being produced to any extent in our hills; or of any wool, least of all the finer kinds, being allowed to grow of sufficient length to be prized in the Europe markets; as the tangled and thorny woods and forests through which the sheep must pass, oblige the shepherds to shear them at least twice, and usually three times in the year. In the comparatively woodless tracts of Trans-Himalayan regions, wool of the finest kinds, and I believe of considerable length, is produced almost everywhere, apart from the inner coat or pashm; and enquiries are being made in Spiti, with a view to ascertain how improvements may be effected; and a superior as well as a more abundant article obtained. It seems to me, however, to be doubtful whether any considerable increase of produce could be obtained from these regions, by any available means, at all events, not under existing circumstances."*

742.—[ ]. Sheeps' wool, from Leia.

In this perganah sheep are shorn twice a year, once in Bysákh and again at the end of Kátak, or beginning of Maghar; from the wool blankets are made, also a few kinds of cloth for putting under saddles, called "sankar;" goats are sheared in Bysákh, as are also camels.

* Extract from Revenue Report of Hazara, 1862-63.

GOATS' HAIR.

This is very commonly produced in almost every district, and called "jat." It is used for making ropes, also for matting, and for the strong bags wherein grain, &c., is carried on the back of oxen. Grain dealers use rugs made of it in the shops in which the grain is poured out when being winnowed, or weighed out.

Goats' hair is exhibited from Rohtak (5528).

Jálandhar (5544).

Gujrát (5639).

Shahpúr (5645), where it is produced in the "bar" tract.

Gugaira (5649).

Jhung (5652).

Maler Kotla (5520), in the form of hair rope.

CAMELS' HAIR.

The soft under wool is of a light-brown color: it is made into chogas of a cheap kind, but they are soft, warm, and useful.

The long hair is not made use of; nor is there any sample exhibited. It is employed in Europe for making paint-brushes.

Camels' hair is exhibited from—

Rohtak (5529).

Shahpúr from the "thal" tract (5647).

Gugaira (which is a great camel bearing district) (5650).

It is a matter of great regret that a Report on the Wools and Silks of the Punjab Exhibition of 1864, which should have accompanied these pages, has never been completed, owing to the absence of tho Reporter, PUNDIT MUNPHOOL on special employment beyond the frontier. Tho list of awards made by the Jury is however, given, as it will serve to show who were the successful rearers of silk and wool in 1864, and what districts carried of the palm.

I. Wools.

District or Locality.	Prize taken.	Description of Article.	Share.	Medal.	Certificate.	Special Prize.	Remarks.
1. Wool from the Hills.							
Spiti, ...	Tehsildar, ...	Sheeps' wool, No. 5560	..	1	1	..	
Bashahr, ...	Raja Bishahr, ...	" 5536	..	..	1	1	Mr. Macleod's Special Prize.
Hazara (Kaghán), ...	Loc. Ex. Committee,	" 5675	16	..	1	..	
Hazara (Abbottabad), ...	" "	" 5677	15	..	1	..	
Ladákh, ...	Maharaja Kashmír,	Sheeps' wool,	13	..	1	..	
Kúlú (Siraj,)	?	"	..	..	1	..	
2. Wools from the Plains.							
Shahpúr, ...	Dy. Commissioner,	Sheeps' wool,	..	1	1	..	
Do. (Bhaira,)	"	No. 5645	..	..	1	..	
Jhilam, ...	Loc. Ex. Committee,	No. 5642	..	..	1	1	Mr. Macleod's Special Prize.
Múltán, ...	" "	" ?	9	..	1	..	
Sirsa, ...	" "	" 6272	8	..	1	..	
Muzaffargarh,	" "						
(Kotadú,) ..	" "	" 5653	6	..	1	..	
Gújrát, ...	" "	" 6742	..	..	1	..	
Jhang, ...	" "	" 5651	..	..	1	..	
Gugaira, ...	" "	" 5648	..	..	1	..	
			67	2	15	2	

II. Silks.

District or Locality.	Prize taken.	Description of Article.	Share.	Medal.	Certificate.	Special Prize.	Remarks.
Gurdaspúr, ..	Jáfir, ...		..	1	1	..	
Lahore, ...	Nazir Khairullah Khan, ...	No. 5620	..	1	1	..	
Gujrát, ...	Loc. Ex. Committee,	No. 5640	..	..	1	1	Mr. Cope's Prize of Rs. 50.
Peshawur, ..	Mr. Huddlestone, ..	..	8	..	1	..	
"	Subhán Mulick of Gurdaspúr, ...	..	8	..	1	..	
Kangra, ...	Tilok Nath, ...	..	7	..	1	..	
Kashmír, ...	H. H. The Maharaja,	..	7	..	1	..	
			30	2	7	1	

SUB-CLASS (E). ANIMAL SUBSTANCES USED FOR MISCELLANEOUS MANUFACTURES, PERFUMERY, DYING, &c., &c.

PERFUMES.

743.—[2500-2505] Series of musk bags, "mushk náfá," of *Moschus moschiferus*, from Sirmúr, Bishahr, Balsán, Kyúnthal, Kumharsen, and Kot Khái.
Simla.

744.—[2502]. Thibet musk. RAJA OF BALSAN.

The Simla musk balls, which are presented as complimentary nazars by hill chiefs, are an inferior kind, and do not command anything like the price of the genuine Thibet balls. About 100 musk bags are imported from Changthán *viâ* Yarkand, of which about 40 go to Yarkand: the rest go to Kashmír and Jammú, and are taken by Yarkandí Pilgrims to Mecca for sale in India or other Asiatic countries: they are produced in the north-west of Rodokh and Nípal; and value at Lé, 7 to 15 Rs. or at Yarkand from 21 to 26 Rs. In former times musk bags from the Dasht-i-Khuttan, or great Tartar desert, were in high repute, and fetched at the least 42 Rs.; but all supply from that quarter has long ceased.*

The animal (the musk deer) is about the size of a young roebuck six months old. The color of the skin is blackish with a mixture of yellow and reddish-brown. It, however, varies considerably in the young animal, being then of a reddish-gray with patches of white arranged in lines, while in the old it is of a blackish-brown color. The most consistent character of the fur throughout the life of the animal is the presence of two white bands bordered with black, and enclosing between them a black band which extends along the under part of the neck from the throat to the chest. The tail has a heart-shaped space around it, naked in the male and always moistened with a strong smelling humour.

On the other hand the females, during the whole of life, and the males up to two years of age, have the tail covered with hair on its upper part, and with wool on its under part: the animal has no horns.

* Memo. by PUNDIT MUNPHOOL on the trade of the Punjab and the countries within and beyond the Dominions of the MAHARAJA OF KASHMIR.

"The mouth opens as far back as the molar teeth; and the male has two canines in the upper jaw developed into the form of tusks; these teeth project externally on each side of the mouth, they pass downward curving backward, and have the posterior edge adapted for cutting. The eyes are proportionally of a large size, and have a long narrow pupil.

"The ears are moderately long, covered externally with reddish-black hair, and internally with long gray hairs. The hinder limbs are longer and stronger than the anterior. An important osteological character is the presence of a slender fibula extending from the head of the tibia to the extremity of the astragulus. The feet are small. The anterior have two spurs which touch the ground, the external being the largest; the posterior have two unequal hoofs the internal being much longer than the external.

"The musk deer is a timid nocturnal mammal, very rapid in its course; it has a leaping motion, something like that of the hare; it leads a solitary life, except in autumn; it feeds upon the leaves, bark, and roots of trees; its flesh is good to eat."*

Musk apparatus.—This consists of a sac, which is only present in the male; it is placed on the median line of the abdomen, between the navel and the orifice of the prepuce and near the latter. The sac is of a rounded oval form, flat on its superior and adherent surface, but convex and covered with hair on its inferior or free surface.

In adults the sac is from two to three inches long, and 7 to 10 lines in depth. The envelope of the sac consists of three separate membranes. On the inner surface of the sac are strongly marked folds and excavations, each excavation contains two or more oval corpuscules, consisting of a very thin membrane, containing a brownish colored substance. These small bodies are glands for the secretion of the musk. Toward the middle of the external surface of the sac is a short canal, which passes obliquely, and has its internal opening marked by a number of converging hairs.

In the living animal, the musk has the consistence

* Extracted from the Elements of Medical Zoology, by MOQUIN TANDON.

of honey, is of a brownish-red color, and has a strong odour.

When dry, the musk is almost solid, granular, and of a dark-brown color.

It feels unctuous and fatty, has a bitter aromatic taste and its smell is powerful. Each sac does not contain more than 370 grains in an adult, and 123 in an old animal.

Two kinds of musk are known in commerce, the *Tonquin*, or Chinese, which is the best; and the *Kabardár*, or Russian.

Musk contains ammonia and volatile oil, stearine, oleine, cholesterine, an oil united with ammonia, gelatine, albumen, fibrine, hydrochlorate of ammonia and several other salts.*

The musk that reaches England is imported from China in chests of from 60 to 100 ounces each. An inferior kind is imported from Bengal (Hill produce).† There is also a Siberian or Russian musk. The China musk bags are always observed to have been opened and sewn up again, and it is probable that adulteration is largely practised: the blood of the animal is often mixed with the musk.

The male animal produces the musk, and is a native of Eastern Asia, between the 30° and 60° north latitude. It is found in the Steppes of the Altai on the Irtish river, extending eastward as far as the river Yenesei and lake Baikal.

In 1857, the import of musk into England was 10,728 ounces.‡

745.—[2530]. Musk. Kághán. DEPUTY COMMISSIONER. Hazara.

746.—[2513]. Musk bags. KANGRA HILLS. Kangra.

These are an inferior kind, and value Rs. 3 to 5 each.

747.—[2531-3]. "Náfa-i-mushk-i-Khatai." Bags of fine Thibet musk. H. H. THE MAHARAJA. Kashmir.

748.—[4310]. 'Atr-i-mushk or Kastúrí-attar, attar of musk. RAM SING, Pansári. Lahore.

749.—[4319]. 'Atr-i-'ambar, attar of ambergris.

Ambergris, from which this attar is prepared, is found in pieces floating in the sea near the coasts of India, Africa and Brazil; it of an ash-gray color, spotted like marble with black spots; but it appears to vary considerably in color, some pieces being white, some black, and some gray with yellow spots. It is very light, and easily takes fire. It is most probably a concretion formed in the stomach or intestines of the Spermaceti whale, *Physeter Macrocephalus*.* Several specimens have been found full of the imbedded beaks of a species of *Sepia*, which is the food of the *Physeter*: it is supposed by some to be formed only during disease, as the specimens of the whale, in the stomach of which ambergris was found, were sickly.

LAC.

The lac insect is found more or less all over India; in the Punjáb it is universal, and there is scarcely a district which does not exhibit a sample.

The lac exhibited is almost exclusively the produce of one or other of the three trees "pípal" *(Ficus religiosa)*, "dhák" *(Butea frondosa)*, or "bér" *(Zizyphus jujaba)*. The dhák specimens have been sent from Kangra district, and also from Kapurthalla. The "bér" lac is the commonest; it is much produced in the Jhang and other districts, where tracts of waste land are covered with the wild "bér." The other trees on which lac has been known to be produced—are *Annona squamosa, Vatica laccifera, Feronia elephantum, Schleichera trijuga;* two species of *Erythrina, Ficus indica, Inga dulcis, Mimosa cinerea,* and others, and species of *Aleurites, Croton, Carisa,* and *Urostigma* and *Celtis.* There are six Hindí names for lac, but the name lák or lákshá, is derived from the word, signifying "a hundred thousand," from the great number of the insects which swarm over the tree. By the punctures they make on the tree, the "lac," is produced.

The products of this insect are two—(1), the "gum lac," which forms a concretion like bubbles over the twigs of the trees on which it is produced; (2), the red coloring matter,

* MOQUIN TANDON, Medical Zoology.
† MACCULLOCH'S Dictionary of Commerce.
‡ DR. URE, Dictionary of Arts, &c.

* THOMPSON'S Chemistry.

to be noticed presently, which yields the highly prized and permanent lac dye.

It is the female insect of the *Coccus lacca* that produces the resin and the dye. This is a small round red colored flat insect, having 12 abdominal rings, and a bifurcated tail. The male is much larger than the female, and is furnished with wings; it is stated that no more than about one male to 5000 females is to be met with. The female insect is said to be destroyed in the process of producing her young ones, for the eggs become hatched beneath the mother insect within the concrete resin globule, and escape by boring though the mother's back. At first the young brood having made its escapo clusters on the twigs of the trees, and very shortly afterwards the incrustation of lac begins to be formed over and round them, covering the twigs. The bubble like exudations are all close together, and hollow and cellular inside. About the end of March the lac resin exudation is complete, and the female insects within are glued down by it to the tree. The oval body of the insect becomes of a deep red color; if at this stage a little piece of the lac incrustation a twig is broken off, the insect is perceived, as a little bag of red liquid (which yields the dye), and the place where the wood of the twig has been punctured bears a snow-white mark, as if the place had been touched with a point of chalk. I have removed an entire piece of lac incrustation from the twig, and observed the bark underneath covered with these little white dots, one in every cell and one under every insect; under the microscope they clearly appear to be specks of a semi-crystalline saline efflorescence, at the place punctured by the insect. The proper stage to collect the lac (if intended to produce dye) is when the insect is in the stage of being like a soft red sac. At a later stage it lays its eggs under its body, which is glued down by the resin; when therefore the eggs are hatched, they have no means of egress save by eating though the body of the mother, which they do, feeding the while on the red coloring matter contained in her body which is thus consumed. When the young insects have regularly eaten through the mother's body (who of course dies under the operation) they pierce the resinous coating and escape. This occurs about the month of June, as soon as the first rain clouds gather, and the lac which is collected after this yields very little coloring matter. Two gatherings are usual however, one about March and one in October, or rather later, up country.

Commercially the best lac comes from Siam, its superiority appears to consist in the uniformity and thickness of the incrustation, which completely covers the twig. Most of the Indian specimens are scanty and irregular. When the lac is first gathered, it is picked off the twigs with the insects and all on it; in this state it is called "kacha or "khám lákh;" this lac is treated with water, and thus the coloring matter is extracted. By this process the concretions of lac get broken up into grains or small fragments, and this forms the "lákh dáná," or seed lac; in this state it contains no coloring matter beyond what is indigenous to the resin.

The third or clarified kind of lac is called "chapra lákh," or shell lac ("chapra," a shell). This is prepared by taking a quantity of the seed lac in a cloth, made up in the form of an oblong bag: two men each holding an end of the bag, extend it over a gentle charcoal fire by which process the lac melts, when quite fluid each man twists the bag so as to force out the melted substance through the pores of the cloth, and allow it to drop upon pieces of the smooth stem of the plantain (*Musa paradisaica*) placed beneath. The glossy nature of this is such that the lac falling on it spreads out in a thin layer without adhering. Sometimes the seed lac is merely melted into lump lac, which is used to make bracelets of.

The chemical constituents of the different kinds of lac from the analyses of Dr. John,

UNVERDORBEN, and HATCHETT, appear to be as follows:—

"Stick lac," *i. e.*, lac on the twigs just in the state in which it is found, contains—

1. An odorous resin, soluble in alcohol and ether.
2. A resin, insoluble in ether.
3. A bitter balsamic resin.
4. Acid of the lac (laccic acid).
5. Dun yellow extract.
6. Coloring matter, analogous to that of cochineal.
7. A fatty matter like wax.
8. Some salts and earth.

UNVERDORBEN classified the resins produced in lac, besides the coloring matters and laccic acid, &c., thus:—

1. A resin, soluble in ether and alcohol.
2. A resin, insoluble in ether, and soluble in alcohol.
3. A resinous body, little soluble in cold alcohol.
4. A crystallizable resin.
5. An uncrystallizable resin, soluble in ether and alcohol but not in petroleum (naptha ?).

Seed lac, "lakh dáná," contains (by MR. HATCHETT's analysis) in 100 parts.

Resin, ...	68·0
Coloring matter, ...	10·0
Wax,..	6·0
Gluten, ...	5·5
Foreign substances,..	6·5
Loss, ...	4·0
	100·0

DR. JOHN's analysis gives very similar results, save that in foreign substances he notices 1·0 of salts of potash and lime, to which probably the white spots on the bark under the incrustations, which were previously noticed, may be due.

Shell lac, "chapra." MR. HATCHETT's analysis gives—

Resin, ...	90·5
Coloring matter, ...	0·5
Wax,..	4·0
Gluten, ...	2·8
Loss,..	1·8
	99·6

Lac resin can be procured pure by solution in alcohol: it makes an excellent varnish.

It is soluble in dilute hydrochloric and acetic but not in sulphuric acid.

"It has a great tendency," says DR. URE, "to combine with salefiable bases: as with caustic potash which it deprives of its alkaline taste.

This solution, which is of a dark red color, dries into a brilliant transparent reddish-brown mass, which may be re-dissolved both in water and alcohol; by passing chlorine in excess through the dark colored alkaline solution, the lac resin is precipitated in a colorless state. When this is dried it gives an excellent varnish particularly with the addition of mastic and a little turpentine."*

Lac burns with a pleasant odour—it is used to make sealing wax, and especially to form when mixed, with sulphur and various colored powders, those sticks of color, ("batti,") used by the turners (kharátí) to color their turned wares, producing that beautiful glossy lacquer which is so much admired, and which gained a medal at the International Exhibition of 1862. The native carpenters make a solution of the crude lac as it is, in native spirits, thus producing a strong colored varnish which they use instead of paint, for house wood-work, &c. In some districts *e. g.*, Jhang, the lac, whether crude or refined, is called "chapra," being regarded as the source of chapra lac, and therefore called so. MAJOR POLLOCK in his report on Dera Ghází Khán states that 80 maunds are annually imported from Jhang to Dera Ghází Khán.

The following specimens of lac were exhibited.

750.—[4050]. Raw or "kucha lakh," from the bér tree. Delhi.

751.—[4132]. Lac on the bér tree, (*Zizyphus jujuba,*) exhibited from Kangra, where it grows at Haripúr and Núrpúr.

Specimens were also sent from
Hushyarpúr (4079).
Lahore (4181).
Gujrát (4141).
Jhilam (1461).
Kapúrthalla (4173).

* URE's "Dictionary of Arts and Sciences."

752.—[2507]. Lac on the "dhák" from Jálandhar and Kapúrthalla.

The leaves of the sample of dhák branches were covered with a blackish dust-like soot, which had a slightly sticky feel, I could not discover the nature of it by the miscroscope, under which it presented the appearance of a surface of confused blackish particles placed without any order or system.

The following extract was communicated by the REV. J. S. WOODSIDE of Kapúrthalla relative to the lac insect.

"About three years and a half ago, or in October 1860, (I believe it was) the Rajah's Oudh Agent sent up a man from Ikanna with about three maunds of the lac, containing the insect in its transition state from the chrysalis into the working animal. The Oudh man remained some 18 months at Phugwara and instructed the man now in charge in the science of lac cultivation. He says they took the lac from the vessel in which it came, put it into detached portions, tied up in little bundles of grass (somewhat resembling the rush butterfly cages we used to make in Ireland). These bundles were tied to the larger branches of the dhák tree, and as the insect appeared it found its way out from the bundle on to the branch and soon made its way up the smaller branches where it commenced its operations. This was in November. There seems therefore to be *two seasons* for its labors, the cold season and the rainy season, the one commencing in November and the other in June. The November crop seems complete in February, and the June crop in September. It is not gathered however till the insect leaves it for the succeeding season. The insect has no wings (so my informant tells me) * but it is carried by the wind from tree to tree. It is also carried by insects and birds, to whose feet it adheres, and thus soon spreads over an entire forest. At first it was placed on 5 or 6 trees at Phugwara. Now it possesses over 100, and is likely to spread very extensively ere long. This last crop was 1½ maunds. The insect is indigenous to the Punjab. It is found on the pípal, the bar (banyan), and the bér, &c. A man tells me that a single tree in his village (a bar I believe) yielded Rs. 12 worth of lac the last season."

753.—[ ]. Lac of the pípal *(Ficus religiosa)* from Rohtak. LOCAL EXHIBITION COMMITTEE.

It is probable also that several of the rough lac samples of other districts are from pípal trees; in the upper parts of the province the "bér" lac appears to be the commonest.

* The males have wings and not the females: the males are however rare.—[ED.]

754.—[ ]. "Lákh dáná," seed lac. This is exhibited from Lahore (No. 4115 and 18), Ambálla (No. 4360), and Delhi.

755.—[ ]. Shell lac "chapra lákh," is exhibited from Delhi (No. 4051), Lahore (4114), Gujrát (4142), Dera Ghází Khán (4613).

LAC DYE.

756.—[4937]. Delhi. Lac dye, exhibited in a liquid form. MUNICIPAL COMMITTEE.

757.—[4469]. Ludhiana. Lac dye, "kirmzi." Ludhiana. BILLU MAL.

This dye is obtained from the lac previously described, by treating the crushed lac with water to dissolve the coloring matter; as before observed, it is best that the lac should be gathered when the insect is within the lac concretions as a small oval body consisting apparently of nothing but a soft red substance nearly liquid. If the lac is not gathered till after the insect has escaped from its resinous envelope, the quantity of coloring matter obtainable is very small.

The dyes exhibited are liquid, they are much used for dying silk; but very seldom, on account of the expense, for cotton. This coloring matter is used also in preparing the red leather of Núrpúr, and other places.

The lac dye of commerce is prepared by evaporating the colored tincture to dryness, when the residue is formed into little cakes, two inches square and half an inch thick; these are of various qualities and are marked with different letters by which the quality is recognized. By the analysis by DR. JOHN, one of these cakes yielded in 100 parts, coloring matter 50, resin 25, solid matter consisting of alumina, plaster, chalk and sand, 22.

The cakes when prepared for dyeing are dissolved in dilute muriatic acid, and tin is the mordant. The lac is used to give a scarlet dye.

DR. MCLEOD, of Madras, as quoted by DR. URE, states that he prepared a superior lac dye, by digesting stick lac (crude lac) in the cold, in a slightly alkaline decoction of the leaves of ***Memecylon tinctorium*** (*M. edule*, Roxb.,) (called kurpa in Bombay), the solution being applied to woollen cloth, after preparation with a mordant formed of a saturated solution of tin in muriatic acid, produced a brilliant scarlet dye.

MacCulloch mentions that in 1853 the imports of lac to England amounted to 1,200,000 lbs.

COCHINEAL.

Besides the *Coccus lacca* just described, there are several other species yielding red coloring matters of more or less brilliancy and value. *Coccus ilicis* is found on the *Quercus conifera*, or Kermes oak; *Coccus polonicus*, form the scarlet grains of Poland; and cochineal is the *Coccus cacti*, which feeds on the *Opuntia cochinillifera*, (*Cactus cochinillifera*, Linn). Kermes was known to the ancients at a very remote date. It is mentioned by Herodotus, and often alluded to by Pliny; and is the "Tola" of the Hebrew Scriptures, which word signifies "worm." Like Kermes the name gave rise to the term "vermillion," "vermeil," which is now applied only to red lead, minium, and Cinnabar. It is remarkable that in all those species the female insect is the color producer, and that the females are very numerous in proportion to the males.

A species of Kermes has been stated to be indigenous to India; but this may be only the mistake of translating "kirmiz," and "krimsi" now applied to lac dye (and also to cochineal) as "Kermes" the *Coccus ilicis*, &c.; but there has been an indigenous species of cochineal no doubt, for in the Jálandhar Doab, there was in the Sikh times a species of cactus so abundant and rapid growing, as to become a nuisance and rewards were offered for its extermination, which however were rendered unnecessary shortly after, as a large number of insects of some kind of *coccus* appeared, and soon effected the destruction of the plant, which is now only occasionally to be met with.

Mr. Taylor communicates the following information from Jálandhar:—

"From enquires I have made in this district I find that the common prickly pear* was very abundant, in Jálandhar and some neighbouring districts. In 1849-50, &c., an insect appeared which attacked the plant and destroyed it completely in the course of a year. The natives describe the insect as about the size of a flea, and state that when squeezed it became scarlet, and that the plant itself when attacked soon became of a scarlet color. They say that the cloth dyers collected them in large quantities, and extracted a brilliant color from it. After the plants had been destroyed the insects themselves disappeared and have only occasionally been seen since. The plant is found in small patches at Rahoon, Kártarpúr and Kapúrthalla, but does not exist in any other part of the Jálandhar district. I am informed it is making slight head way however, but no appearance of the insect can be traced."

In the genuine cochineal the female is much larger than the male. The larval stage in both sexes does not last more than 13 days, that of the pupa 15. The male does not live more than a month. As soon as born he seeks the female and when impregnation is accomplished he dies. The female lives a month longer, during which period her abdomen becomes much enlarged. When the period for laying her eggs arrives, she fixes herself to the plant: the eggs adhere to the under surface of the body, and so are hardly visible; as the eggs are discharged the body shrinks, thus affording a cavity under it in which the eggs rest. The eggs are from 250 to 300 in number, united into a narrow band; they are oval and of an intense red color, and covered with a farinaceous secretion; they are hatched in a few days, and like the lac insects, issue though the dried up skin of the dead mother.*

The good cochineal which was exhibited, and which yields the beautiful dye for silk, is imported, and comes *viá* Bombay and Calcutta; some of it appears to come *viá* Bukhára, whence it first goes by the Afghan traders from Sindh, Karáchí and Bombay, and then is brought into the Punjab through the Peshawar passes by Kabúlí merchants; but no doubt the greater proportion is imported

* The plant *Opuntia vulgaris*, nat. ord., *Cactaceæ D.C.* It is common in America, where a species of cochineal insect lives on it.

* (Moquin Tandon. Elements of Medical Zoology, p. 27.)

direct from Bombay and Calcutta; it finds its way into Kashmír partly by the Bukhára trade, but also from Amritsar. It is almost exclusively used in dying silk.

Cochineal is found in Central America, Mexico, &c., and has of late been much cultivated in the Canary islands, from which in 1856, no less than 1,511,617 lbs. were exported. Cochineal is both wild and cultivated.*

"The insects," writes MACCULLOCH (Commercial Dictionary) "of which there are about 70,000 to the lb., are detached from the plants on which they feed by a blunt knife; they are dipped in boiling water to kill them, and then dried in the sun." They are imported in bags holding about 200lbs. each; they do not deteriorate by keeping. It may be added that the imports of cochineal into Great Britain is for 1856 (the latest year for which data are available here) amounted to 18,123 cwt., the real value of which was estimated at £391,661. In the London price lists for June 1864, the price of good cochineal ranges from 3s. 3d. to 4s. 4d. the lb.

The coloring matter is due to a peculiar principle, termed carminium or cochineline. This is soluble in alcohol. Acids turn the solution orange red, alkalies to violet. The various "lakes" of artists' colormen are prepared by mixing cochineal solution with recently precipitated aluminous earth with which it combines, giving a beautiful crimson precipitate. The "carmine lake" is heightened in its color by an acid salt, such as bitartrate of potash; muriatic acid makes cochineal a brilliant scarlet. As a dye in Europe it is fixed by tin mordant and heightened in color by supertartrate of potash. In this country alum is used as a mordant, and gives the crimson dye. In order to dye scarlet, some yellow dye, such as "harsinghar," is employed along with it. (See Class of Dyes.)

758.—[4573]. Imported cochineal.
Lahore. GHULAM MAHBUB SUBHANI.

759.—[4659]. Cochineal, imported
Peshawur. from Bukhára.

Whence it was imported from Bombay: value, Rs. 7 a seer.

760.—[2508]. Cochineal (imported).
Jallandhar.

761.—[ ]. "Hardwárí peori," or Indian yellow. LAHORE BAZAR.

This is the dried deposit precipitated from the urine of cows that have been fed on the leaves of the mango (*Mangifera indica*).

It consists principally of magnesia and "purreic acid," as it has been called by SIR R. KANE. On treating a solution with weak muriatic acid, after evaporation, yellow scaly crystals of purreic acid are obtained.

This substance is usually met with in the bazars in lumps, called "hardwárí peori,"—what is called "wilayiti peori" is chrome yellow in lumps (chromate of lead). Hardwárí indicates the locality where it is obtained. I am told that a dye made of the Harsinggár is sold under the same name.

* It has been also introduced into Spain and Algiers. The impregnated females or ones full of eggs have been carried on little pieces of cactus from the original place to the new one. Indeed thus the principal "nopalries," or cochineal gardens are formed—1st, the cactus trees are planted in rows about a yard apart, protected only by a high hedge from wild beasts and violent winds—the egg-bearing females are collected from the woods and placed in little nests of cocoa-nut fibre or other material, and the eggs soon hatch, the insects then emerge and crawl all over the nopal or cactus plants, where they soon become naturalized: they require protection of mats from rain and excessive heat.

† BRANDE, Dict. of Sciences.

CLASS III. PRODUCTS OF THE VEGETABLE KINGDOM USED FOR FOOD.

Division I.—Substances used as food for man or cattle.

THE collection illustrative of this important section was very large, but as the jury remarked, consisted to a certain extent of grains very similar in quality and general appearance, although they were obtained from different districts.

Now the general features of the majority of districts being so much the same, as far as composition of the soil is concerned, it is but reasonable to expect that the produce in a majority of them should be similar, the difference being more in the amount of produce in a given area, and in the size and fullness of ear than in the nature of the grain itself.

There are, however, certain marked divisions of the province, dependent on physical peculiarities of geographical situation and climate, which exhibit diversities of produce, and these divisions are further noticeable from the change of nomenclature, which as we pass from one to the other, we cannot fail to observe both in the grains themselves, in the soils which produce them, and in the implements of husbandry and irrigation by the aid of which they are cultivated.

In reviewing the agricultural produce of the whole province, from the rocks and snows of the far distant Spiti and the fruitful valleys of Kashmír, to the arid plains of Múltán, and the river banks of the Deraját, the conditions of cultivation are so various, that it will materially add to the interest of this class, as well as illustrate the specimens contained both in it and in some of the subsequent ones, if I lay before the reader a brief sketch, descriptive of the various kinds of culturable soil, both in the hills and in the plains,—of the means of irrigation,—the principles on which agriculture is conducted, —and of the characteristics of the agricultural population of the Punjab.

In order to do this, I shall endeavour briefly to consider the following points:—

First, The soils,—including such information as we possess regarding systems of rotation, manuring, &c; *Secondly,* The means of irrigation adopted; *Thirdly,* The classes of persons who work the soil, as these from their habits and peculiarities will be found to exercise an important influence on the productiveness of the lands under their treatment; *Fourthly,* The method of treating and cultivating the various crops; and, *Fifthly,* The produce itself, as to its quantity, quality, its cost, and the profits it yields to the agriculturist.

The consideration of the implements of husbandry in use in the Punjab would be here out of place, as there is a special class in Section C. assigned to models and specimens illustrating the subject, and to this class I would refer the reader for information.

I. SOILS.

I have already (at p. 123) in a Geological sketch of the province, noticed the different kinds of soil which characterize the districts of the Punjab. I shall, therefore, in this place confine myself to a consideration of them from a purely agricultural point of view.

The classification of soils, as has been already observed, is of a two-fold nature,—either according to the means of irrigation which are at hand, or else according to the character of the soil itself, though not unfrequently the terms in use are the result of a combination or confusion of both together; in some places also, the use of artificial fertilization furnishes a fourth kind of name or distinction.

After perusing a series of statements collected for the Lahore Museum in 1860, descriptive of the agricultural produce of various districts, it is evident that the different nomenclatures of soils have certain limits, or divisions of the province within which they are current.

Some doubt must unquestionably attach to these divisions when it is remembered that the native officers and assistants employed in making out the settlement records often introduce terms which previously had no local currency. Making full allowance for this, however, there is still evidence of a pretty clear partition of terms indicating difference of soil.

First, there are certain hill districts of greater or less elevation, either Himálayan or Sub-Himálayan, like Simla and its States; and intramontane valleys, such as Kangra, Kashmír, Hazára, and Peshawur; and submontane, such as the southern margin of the lowest ranges, known as "Dámani-i-koh," from Bhimbar to Rúpar, or on either slope of the Pabbi range in the Gujrát district, which have names of their own, resulting partly from peculiarities of situation, and partly from difference of race. To these I shall devote a separate notice.

After eliminating these, the rest of the province exhibits three main classes of nomenclature:—*First,* Those districts (like Jhang, Gugaira, Múltán and some others,) whose cultivation is so poor, that were it not for canals, wells, or the banks of a stream, they would have none at all, appear to have very little nomenclature of soils according to kind. What they have, has almost exclusive reference to *means of irrigation*: this is very natural; if they had no *water*, it would matter little whether clay, sand, or loam formed the staple of their soil, as the average rain-fall is at the utmost not more than 8 or 10 inches, it would bear nothing but jungle; hence the whole attention is drawn to the fact of there being means of irrigation of one kind or another, and the lands are distinguished accordingly; *Second,* The districts in which Punjabí terms are in vogue,—Chamb, Rohi, Dorangí, Dosháhi, Misí, Maira, Tiba, Kalrátí, Shor, &c.,—which I shall describe presently: they comprise the Jálandhar, Barí and Ríchnab Doabs, as also the Jach and Sindh Ságur Doabs, in such parts of them as land is distinguished by soil, and not irrigation appellatives; *Third,* The districts in which Hindustání terms—Khádir Bángar, Rausli, Dákar, Domat, Matyár, Bhúr or Bhor, &c., are recognized: these comprise the Cis-Sultej States, Ambálah division, and the districts of Gúrgaon, Delhi, Hissár Rohtak and Sirsa.

This threefold classification is only general, and no doubt there are districts where either or perhaps all the names are understood; but the distinction is certainly true in the main, judging from the use of the one set of terms or the other in the various districts from which the returns have been received.

The classification of land according to means of irrigation is understood everywhere. Even where terms descriptive of *soil* are employed, any or every class of land may also be described as "*chahi,*" if it is watered by wells; "*abi,*" if by ponds; or "chalárs" (to be described hereafter); "*sailábi,*" if by flood and inundation of rivers; *páni már,* if damaged by drainage floods; and "*baráni,*" if dependent on rain. These names themselves indicate the source of the water of irrigation.

In Múltán and Jhang, and some other districts also, where these irrigation distinctions

have been noticed as the only ones in use, the term *nahri* from ("nahr," a river or canal) is used to signify lands watered by canals; and in Múltán, where cultivation is almost entirely dependent on that system of multitudes of branch canals, which is characteristic of the district,* there are several terms in use having reference to this method of irrigation. In the low tracts of Bajwát in Sealkot, and of Andar in Gúrdaspúr, which are intersected by a regular net-work of streams, the terms "kúlí," from kúl, a water-course, and "pail," a rich kind of loam, are used to signify lands under this species of irrigation.

II. We now come to the "Punjabí series" of soils.

The plain districts of the Punjab are subdivisions of Doabs,† *i. e.*, tracts of country between two rivers. These rivers exercise an influence over the soil to a greater or less extent, on either side of them, and the existence of this influence is proved long after the actual proximity of the stream is passed, by the slight depth at which water is obtained from wells, and by the productiveness of the soil generally.

In the immediate vicinity of the stream, there will be tracts enriched by its alluvial soil, and fertilized by its inundations. The perpetually shifting currents of the Punjab rivers form one of the most remarkable features. Large tracts of land are frequently carried away from one place, while at another part of the stream, a rich deposit of alluvium is thrown up; and it not unfrequently becomes a source of dispute among the neighbouring landowners, who is to possess the new tract.

As regards the revenue assessment of lands thus thrown up, or the reduction of rent on account of fields washed away, it may be mentioned that there are several methods employed in different parts of the country for ascertaining the value and extent of the alteration required. In the Punjab sometimes the "chak" system is followed, whereby low lands likely to be affected are divided into plots or chaks, and at settlement general rates are fixed for each, which rates are applied to the increment, whenever it occurs; sometimes the system of merely taking up each case as it occurs and reducing or increasing the rent after actual measurement is followed.*

Occasionally, however, the river brings down masses of sand instead of rich soil, and then its effect is the reverse of fertilizing.

Beyond the immediate vicinity of the river, there will be land varying in quality according to circumstances, and including a number of kinds of soils; rohi, dosháhi, &c. Approaching towards the centre of the Doab the influence of the river is less felt, the wells yield water at a greater depth, the poorer class of soils and Baráni tracts become more frequent. In the centre of the several Doabs, west of the old Grand Trunk Road from Firozpúr to Jihlam, and equidistant from the influence of the rivers on either side, is the "*bar*" tract, generally higher in level than the rest, almost wholly covered with stunted jungle, and good only for grazing grounds for the large herds of cattle and camels, which are reared in such districts. In these parts, what cultivation there is, is dependent on rain, or on wells sunk to a very considerable depth.

* See First Report of the Administration of the Punjab, para. 350, also in Class III., Sub-class (*D*). Dyes, where further mention of the Múltán canals is made in connection with indigo cultivation. I believe the number of the small canals that formerly existed was reckoned at 257.

† The names of the Doabs are in all instances (excepting the first or Jálandhar Doab) the result of a rude attempt to join the names of the rivers on each side into one word. Thus passing the Jálandhar Doab, between the Sutlej and the Beas, we come to the *Bari Doab*, (*Beas* and *Rávi*.). Then between the Rávi and Chenab, the *Richnah Doab*; between the Jihlam and Chenab, is the *Jach Doab*. The last Doab up to the Indus, take its name from that river, and it is called *Sind Ságar*, "the ocean of the Sind" (Indus river).

* In 1858, the loss by diluvion was 51,283 and the gain by alluvion 12,360. In 1859 these figures became 23,071, and 18,802, respectively. A full account of the system of settling cases of alluvion and diluvion will be found in the Financial Commissioner's Circular, No. 81, dated 7th September, at page 562, of the Volume for 1860.

It is now time to describe the various kinds of soils, beginning from the bank of the river, and moving inwards towards the "bar" tract of the Doab.

1. Deposits of moist alluvium extending along the bed of rivers, on which grow tamarisk ("pilchí"), "sarkanda," and the "múnj," (large grasses, of the species *Saccharum*,) are called *bela*.

2. Land periodically inundated by the rise of the river is called *bhet*. It often has an efflorescence of "reh" or "kalar" (sulphate of soda), which renders it less productive. In Lahore and neighbouring districts all the low lands are called "bánjar" or "khachi," and in some places "hetár" and "sailába." In the Leia district, where there is land inundated, the land adjacent to the river is called *sailábi;* this describes land that is *not* periodically inundated itself, but is adjacent to land that is, and is thus constantly moist; 2nd, "kachhí," consists of rich loam over sand, periodically inundated during part of the hot weather and the rains. In the desert the soil is all sand, but where the jhand tree grows it is called "jhandi wali thal," it consists of a mixture of earth and sand, and is good. Manured earth round the villages is called "púwah or puwár."*

3. The next series of soils do not occur in regular order of succession, but they are, in varying degree, good culturable kinds of land, and where they do occur they are in that portion of the Doab which falls more or less within the influence of the river.

The land next beyond the "bhet" soils, and which is beyond the influence of inundations is generically termed in some places "*desya*," and still further inward "*des*," and also utár, in contradistinction to hetár. In Lahore and Amritsar, "máhjah" is a generic term applied to all the higher lands above and beyond the range of inundations, and "banjar" to land situated still higher, and entirely dependent on rain. In the heart of the Richnah Doab, as we recede from the Rávi, the country is saline, hence locally called "kalar," and higher up, "charkari mahál," from the prevalence of wells (chark.)

The first variety of soil is the "*rohi*," which is a stiff loam free from sand, breaks into large clods, and is the finest natural soil. If the calcareous concrete known as "kankar" or "ror," is mixed up with rohi land, it is called in the Gujranwalla district, "*kalrathí*:" it is then not so productive, it often occurs in the neighbourhood of barren or "kalri" tracts. In some places the loam is apt to split into wide fissures, and there it is described as "phatwí rohí," there is also a clay soil called "pail," which is a fluvial deposit and found in sub-montane canal irrigated tracts.

In the next four kinds of soil the distinctions are based on the proportions of sand.

Thus, *dúsháhi* or *dosahí* is the same as rohi, except that it has some sand in it. *Misi* again has more sand, so that the soil is half and half sand and clay. In "*maira*" soil, the sand predominates over the clay; and "*tiba*" is almost entirely sand, in fact it sometimes occurs as hillocks of pure sand, where it is known as "rétí;" of these terms, the word doshahí literally means "doubtful," that is land about which there can be two (do) opinions (shái); it consists of fields of which part is high and sandy and part is good soil.* "Tibá" means a hillock, and the term is especially applied to uneven sandy ground of a somewhat high level. Such poor soils as the last, occur in the central or "bar" lands, which are mostly sandy tracts of jungle and grazing grounds. In other districts,

* Journal Agri-Hort. Society of India, Vol. VIII., p. 51.

* I have also been told that the word is really dochhái, and means "partly sandy" (chhái = sandy soil). But the above is probably the correct, and has its counterpart in the Hindústani, "domat," which has precisely the same signification. WILSON (Glossary of Indian Terms,) gives domat as equal to *do matti*, *two* kinds of earth mixed; he also gives doshahi, as meaning land bearing two harvests, but gives no authority for this latter interpretation.

as Gugaira and Shahpúr, these bar tracts are very extensive, and have a peculiar growth of shrubs, grasses and plants, which are full of interest to the botanist, and some of them of value economically.

The following extract from CAPTAIN (*now* COLONEL) ELPHINSTONE's Settlement Report on Gugaira, well describes the products of the "bar":—

"The remarkable similarity in the vegetation of arid regions, separated from each other by many degrees of latitude, has often been a subject of notice. Thus not only the physiognomy of the plants which are found in the bar of this district, agrees in a remarkable degree with those said to be met with in the wastes bordering on the Caspian sea; but most of the genera which abound in the southern steppes of Russia, have representative species in this part of the Punjab. I need only mention the Salsolas, Salicornias, and Suedas, which cover every patch of saline land, and are largely used for the manufacture of sajji, or impure carbonate of soda. The kurreel (*Capparis aphylla*), the jhán (*Tamarix indica*), the furásh (*Tamarix orientalis*), and the bér, (*Zizyphus vulgaris*), which compose almost the whole tree vegetation of the bar, have analogous species on the shores of the Black sea and the banks of the Volga. The same resemblance may be traced in the herbaceous vegetation, which here chiefly consists of *Peganum*, *Alhagi maurorum* (*gewassa* of the natives), which forms the chief food of the camel, and of various chenopodaceous plants, with grasses of the usual species met with in the North of India. The khaskhas (*Anatherium muricatum*) abounds on the banks of the rivers, and is exported in large quantities to Múltán and Lahore; and the *Saccharum moonja*, or "surr," covers immense tracts of inundated lands, and forms the chief difficulty of the agriculturist, as it rapidly encroaches on the cultivation. The useful ropes made from this grass are well known; and here I may observe, that DR. ROYLE in his work on the fibres of India, states, on what must have been erroneous information, that cordage is made out of the leaf of this plant. The sheathing petiole is the only portion used: the leaf itself is brittle and is invariable rejected by the native manufacturers."*

The names above enumerated, describe all the principal varieties of soil, but in passing over a district, we are sure to come upon tracts of country which are affected in a peculiar manner by some local cause—lands, which if that particular local influence were absent, would in their nature fall under one or other of the ordinary denominations of soil. When these influencing causes are present, the quality of the soil in an agricultural point of view is changed, and accordingly it receives a new name.

Where there are low tracts of country, and which owing to their depression receive the water that runs off from the surrounding higher lands, and in which also during the rainy season the water lies because the drainage channels are insufficient to carry it all off, such tracts are called "*chamb.*" This lying of the water causes the soil to be heavy and black, or dark in color.

If the low tract where the water lies in this manner happens to be by nature rohi land, then it is called "*chamb rohi,*" and yields good crops of rice and gram. If in a high tract the soil has indications of saline efflorescence, it is called "*chitta rohi,*" from its white color, the yield of wheat is often good notwithstanding.

If the chamb tract be upon "*maira,*" or "*tibba*" soil, it forms unproductive hard jungle, which bears little else than grasses, such as khaskhas, dab, the leafless caper (*Capparis aphylla*), the jál (*Salvadora*), and such like jungle produce, this is called "*banjar*" or "*chamb banjar.*" The name banjar is also given to any hard barren tract, and also land allowed to lie "fallow" is described as banjar.

These "*banjar*" tracts are subdivided into different kinds. "*Kalr*" is that which produces nothing but grass, which springs up only during the rains; it is not arable and is a little impregnated with saline matters.

"*Shor*" is a kind of barren land, which swells after rain and yields "reh," an efflorescence which consists principally of sulphate of soda, and is fatal to the productiveness of any soil. A third class of banjar land, called *utar*, is a hard level plain

* A very striking account of the bar tract is given in the First Administration Report of the Punjab, para 6.

perfectly unproductive, which has a hollow sound to the tread.

Goera or *nyáin*, is not properly speaking a kind of soil. It is a term applied only to lands in the vicinity of wells and villages, which are abundantly irrigated and manured, which is the great distinction. This is the most productive soil, and on it are planted the valuable or "zabtí" crops, sugar-cane, cotton, tobacco, poppy, &c. Actual desert soil is called "thal." MAJOR-GENERAL CLARKE mentions that in Gujranwalla the tract of country along the river on which the villages are mostly situated, is called generically "kandi." In Shahpúr, where the old bank of the river runs down the Doab, the land is called "nukka," while in other places, land situated in such ridges are described as "dhaya."

In the Jhilam district manured land is called "hail." "Mera," is good land; "las," somewhat inferior; and "rukr," is bad soil.*

These are the principal names for soils of the "Punjabí" class, but the list does not profess to be exhaustive, there are no doubt many other terms in local use, probably varying from perganah to perganah, and even from village to village, but such minutiæ cannot be entered on in a general sketch like the present.

III. I pass on to the class of "Cis-Sutlej" nomenclature. This is more or less that of Hindústán. This division of soils has been very clearly described by MR. WYNYARD, in his Report on the Settlement of Ambálah, to which I am much indebted for information on the subject.

The two great divisions of land are *khádir* and *bángar*. (Not to be confounded with the sterile "banjar" soils of the Punjabí series). Khádir are low lands that owe their depression to having once been the beds of rivers, or levelled in some way by the influence of river action. Khádir would be equivalent to "bent" in the foregoing series.

* BRANDRETH's Settlement Report of the Jhilam district.

The other term, *bángar*, includes the higher lands, answering to the generic terms "des" and "máhjah" in the 2nd series. In this tract the wells require to be sunk deep. The water is met with at from 30 to 60 feet, and there is abundant.

In short, these terms are descriptive rather of tracts of country according to situation, &c., than kinds of soils.

The *kinds of soils* into which they are sub-divided are as follows:—

"*Nyái*" is rich land near villages, subject to constant artificial irrigation, and generally fertilized by manure like the "goera" of the other series.

"*Rausli*," is a light loam producing all crops, except rice. It is soft and easily worked, consisting of clay and sand; it is mostly like, though superior to the "*doshúhi*" in the Punjábí series. Heavy clay land where the water lies, and which is good for rice and gram, is called *dákar*, answering to *chamb rohi*. *Rákar* is bad dákar, which will only grow rice.

"*Bhúr*," answering to "*maira*," is a light sandy soil, the better kinds of it produce bájra, moth, másh and jowár. Low lands like *chamb*, that receive the drainage of neighbouring uplands, and cannot carry it off so that it lies, are called "*choil*." They are unproductive for want of drainage. High tracts from which the water drains off quickly, are called *magra* and *thalli*.

Of the regular Hindustání terms, "*matyár*" is the equivalent of "*rohi*," above described; *misán* of "*misi*," and "*domat*" of "*dosáhi*."

IV. I now come to the nomenclatures of the hill districts, including both hills and intramontane valleys. With regard to these the names and distinctions of soils are few, and in many districts not recognized at all; nor is this wonderful when we consider the nature of the country, how for the purposes of cultivation *any* site has to be seized on, where a level field can be constructed, and irrigation is available.

In the Kangra district the main distinctions appear to be, in the fact of one harvest or two being yielded: the first land is *do-fasli*, and the best of that again is called "*bilúchi*," "*asli*," or "*larhi*," which COLONEL TREMENHEERE says, may be translated "homestead."

The second quality of *do-fasli* land is called "dalanúr behaoli." The third kind of land is *ek-fasli*, that is, land that only bears one harvest; while such land as is often allowed to lie fallow, is called "bahun banjar." Irrigated land is distinguished as "kúli," from "kúla," a water-course, unirrigated, as "utar," (or upper land).*

In the district of Bunnoo, the terms in use are distinguished by the soil according to its irrigation by canals or other water-courses, and also by its capacity for producing one or two harvests. Nahri or chahi (land watered by canal or well) is here called "*tandoi*." Báraní land irrigated by rain is called "*wacholi*." Desert land or thal, is called "*aumá*."

With regard to the Kuhát district, the Deputy Commissioner, CAPTAIN SHORTT, has communicated the following information:—

The best land is called "bárí," that which is near the villages, like the goera or nyáin. If manured it yields two harvests.

The second quality of land is called "ek-fasli." It is not manured, and yields, as its name implies, only one harvest in a year.

The third quality is distinguished by the name "shand," this is allowed to lie fallow for two harvests, and is then cultivated only for the rabi.

The fourth kind is "math," it is a good quality of land, and is retentive of moisture, and will, if manured, yield two harvests in the year.

The fifth kind is "regi," that is mixed with sand, or adjacent to the bed of a nallah or hill stream, "shelah," which has washed down quantities of sand.

* These names are on the authority of COL. TREMENHEERE.

The sixth class of land is called "lúrah," this is of inferior quality; by the passage of water over its surface it becomes furrowed and uneven, "algad."

The seventh kind, or "dág" land, is also bad, is at a distance from the villages, and is only once cultivated in an interval of three or four years.

An eighth kind is "dab," this is good land and is retentive of moisture; it yields with manure two harvests.

"Tand" is the ninth kind; is described in the original vernacular paper, as "chughar," moist and cool, and retentive of water.

"Hawár," is a tenth kind; the word is probably a corruption of "hamwár," as it is described as perfectly level, and it produces neither grass nor jungle, and is cultivated only once in two years.

"Abí" land, is a distinction also recognized in this district; and lastly, "lalmi," is a kind of land of which, however, no particulars are given.

In the Hill states of Simla, I am informed that the difficulties of cultivation generally, and the ignorance of the people, combine to prevent a discrimination of soils; but this is not altogether the case in these submontane districts, which though they have not the peculiar crops and the rigid climate of the higher regions, are yet quite distinct from the districts of the plains. To illustrate this class of district, I extract from MR. MELVILLE's Ambálah Report, an account of Kotahah, one of the submontane districts in the Ambálah border of the lower Himálaya, and close to Sirmúr. Many of the products contained in the collection were derived from thence and from similar States, and these peculiarities therefore deserve notice.* MR. MELVILLE writes:—

* The natives give generic name "dáman-i-koh" (Persian) or "kandi," to the low hills that form the basis of the higher ranges, and in which such hill States or Kotahah, and others are situate.

"This tract of country is at present bounded on the east and west by the Sirmúr territory; on the north-east by the country held by the Pattiala Raja (comprising Pinjore); and on the west and south-west by the plains, which belong partly to the Meer, and partly to the Ramgarheeah Sirdars. In shape this hill tract is more oval than anything else.

"There are two main ranges of hills within its limits; one on the east, the other on the west side, and both running through its extreme length. Between these ranges, there are numberless spurs branching out in all directions. The western range is connected with the plains by numerous ridges sloping down pretty gradually.

"The main ranges are at a considerable elevation above the plains. No great heat is ever experienced in the highest points of them. The eastern side of either range is the most favorable for cultivation, both the land and crops being better than on their western slopes.

"Before proceeding to detail the old revenue system obtaining in these hills, I will give an account of the different soils. There are 1st, 'koolahoo,' or land watered from kools (*i. e.*, small water-courses from a stream, &c.); 2nd, 'obur,' or land dependent on the heavens for moisture—(baránee.) The 'obur' land is divided into three classes:—'Toduh,' 'first kheel,' and 'second kheel.' The Toduh land is that which is built up into hanging fields (a field is here called 'bughuree,' not, khet) one piled above the other, very narrow, and universally of very small size. It is known as 'uvul' (first class) and 'doyum' (second class) by the people. The first quality is that which is free from stones, is manured and produces well. The second is dry, stony stuff, not worth much. The koolahoo and toduh lands are always ploughed. The kheel is that land which is broken up on the high slopes of the hills. It is rarely ploughed. It is dug up by a small hoe, called 'kussee.' It lies fallow for a period varying from three to twenty years. Where the hill side is not very steep, the superficies of soil is deeper, because the rain does not wash it away so easily as on the steep sides. In the first case, crops can be grown at lesser intervals; but in the latter case, it is necessary to allow a long interval to elapse, before another sowing can be attempted. The reason of this is that no kheel in such localities is ever broken up without it is covered with jungle. The jungle is cut down and burnt, and the ashes mingled with the soil, and until first wood springs up no attempt is made at cultivation. The method of cultivating the kheel in the rougher parts of the hills, will be subsequently explained. Level land is called 'seer.'"

Of hill districts generally it may be remarked that as a rule they produce but little, and almost all Hill states are obliged to import their food. The soil is generally good, though often it is worked with great difficulty on account of the quantity of stones it contains. In all the lower hill regions especially, the formation consists of conglomerates, full of blocks and boulders of the primary strata of the higher hills, and hence the fields are found to be encumbered with masses of granite and slate. The cultivators cannot move these, nor can they remove them by blasting, so the soil has to be turned as it may, the laborer working in and out among the stones. The fields are generally on a sloping place formed into terraces, each one being a little lower than the one above it; each field also is edged with a little embankment, and the water for irrigation being let in upon the upper fields, overflows them and runs down to the next, and so on.

In the upper hills cultivated spots are to be found wherever there is sufficient soil upon the steep hill-side to make it possible; the fields are always ranged in terraces like a flight of steps up the hill side, and are often so narrow as to be literally like a stair-case; in fact these little plots have no connection with the European idea of a field. The edges of the terrace fields are heightened by loose stone dykes, this retains the water for irrigation, while an opening allows the surplus water to run off into the lower fields.

V. *Rotation of Crops, Manuring, &c.*—It is perhaps not too much to say that rotation is not practised, if we explain the term rotation to mean the principles on which, having ascertained the requirements in soil constituents of the various kinds of crops, the farmer plants them in such order of succession that when one crop has exhausted the land of one of its elements, another should be planted in its place next year, which does not require that particular nutriment to ensure its growth, and which

moreover, by its own exuviæ tends to restore to the soil the particular constituent of which it was deprived by the former crop.

Such a principle is almost unknown: and although there is a succession of crops practised, it is chiefly observed in lands that have been manured, where, in order to make the most of the fertilization effected, the next sowing consists of crops which require rich soil, and the next of those requiring less richness, and so on. For instance, in the Cis-Sutlej States, wheat follows sugar-cane, and cotton, wheat; thus the manuring once laid down for sugar-cane lasts for three years' crops. Otherwise in the Cis-Sutlej States, barley and gram *(Cicer arietinum)* follow rice; tobacco follows cotton; sugar-cane sometimes is grown after maize: this rotation is followed also in other districts.

In Múltán, turnips and "múlí" are grown after "jowár" *(Holcus sorghum)* and wheat.

In Hazara, barley for the spring harvest, is followed by maize for the autumn—"moth" *(Phaseolus aconitifolious)* for the autumn by wheat in the spring. Cotton in autumn by maize in spring: "channa" *(gram)* by wheat.

In Gujrát and other districts, wheat, maize, barley and jowár follow in succession. As these are all cereal grains, they cannot relieve the soil much.

But in many districts it constantly happens that year after year, the same crop is sown—fallow being the only rest the land gets.

In the Kangra district, where rice is the important product, a system of rotation which appears almost fanciful, is carefully observed in growing the different kinds of rice.

"*Básmati*" rice is invariably sown in the finest kinds of soil, after linseed and wheat, and the same variety of rice is never sown two harvests running on the same soil. And Mr. Bayley remarks that as the varieties of rice are almost innumerable, there is ample room for succession.

On reviewing these practices of rotation there appear, no doubt, some among them that may be beneficial. They are followed because having been once or twice found to answer—they have passed into a custom, but the farmers have no knowledge of the reason of rotations, or how to improve on the system they follow.

Land is often allowed to lie fallow wherever the owner can afford it; sometimes for the whole year, sometimes for one harvest only. In Sealkot ordinary fallow land is called "báhan;" when it has lain fallow for more than a year after an exhausting crop like sugar-cane it is described as "barhyál." Not unfrequently the farmer divides the area of his land in half; and for one year cultivates one half for the spring harvest and the other half for the autumn harvest. Next year after this, the half that was used for the spring is not again cultivated till the autumn of the following year, (lying over two harvests,) and the half that was used for the autumn, lies over the next spring and autumn, and is cultivated again for the spring following; thus each half lies over two harvests before recultivation.

Manuring is much practised in the vicinity of villages, but beyond them only for the best crops, such as sugar-cane, cotton and rice, where grown near wells. Some kinds of crops, as poppy, sugar-cane, maize, &c., require, or greatly benefit by manure. Every village has a place where manure, consisting of ordure and ashes, and every kind of refuse is heaped: sometimes the owners possess separate heaps. The right to a share of the manure is not unfrequently a cause of dispute.

The manure is seldom or never used fresh, it is allowed to accumulate from six months to two years, after which period it is not kept, as it loses its fertilizing property.

Sometimes the manure is put on the land before ploughing and gets mixed in, sometimes it is added after, and sometimes also it is applied by hand labor after the crops

have sprouted, two or three times over, especially where the soil is poor. For the crops of the spring harvest manure is laid down in October; for those of autumn, in May.*

Besides this kind of manure, decayed leaves are esteemed, and worm-eaten wheat is thought excellent. In indigo making districts, the indigo plants after steeping are used as a valuable manure. In the Kangra valley, in the low watered tracts at the foot of the lowest ranges, and in Sealkot and Gujranwalla, along the banks of the Deg, where much rice is grown, chopped straw and offal are largely used as manure.

In the Gujranwalla district, a habit prevails of laying down ashes from brick kilns on the floors of cattle sheds. The ashes protect the cattle from the cold ground during the night, and next morning being carried out with the litter, becomes exceedingly fertilizing as manure.

Very often the stubble of sugar-cane and rice are set fire to, the charred remains being considered very fertilizing.

The sweepings of old brick walls are also spread over the fields. In some places the earth that has crumbled from old mud walls is thought a good manure.†

It would appear that in some parts of the Ambálah division, a practice exists of occasionally growing a coarse kind of millet, sawánk, (*Panicum frumentaceum,*) which is ploughed into the soil green as a manure.

In some districts of the Deraját, the urine of camels is valued as manure.

In the hill districts, manure is of the greatest importance, and land is almost always manured before sowing.

Of Kangra, Mr. E. C. Bayley, writes:—

"In Kangra the droppings of the flocks of the hill shepherds who bring both sheep and goats to feed in the lowlands during the winter, are much sought after. I remember a case in which a civil action was brought against a gaddi (sheep farmer), by the owner of a certain field, in which the gaddi had been in the habit of folding his sheep for many years, in order to compel him to continue doing so."

The following extract relating to Kanáwar, is equally applicable to all the hill districts of similar situation.*

"Every cultivator heeps up before his door or under his house the dung of all the sheep and cattle, and mixes these with the dry grass and leaves used for littering the animals. Oak, pine and rhododendron leaves are most used. To this are added the dried capsules of poppies and the shells of walnuts, with refuse chaff (*bhoosa*) when not required as fodder. Indeed this branch of rural economy is well attended to, and these substances having lain during the winter months are found to be well mixed and rotted in spring, when they are applied to the soil both at the time of sowing and after the plants appear above the ground."

II. Irrigation.

Is firstly effected by natural causes—rain, rivers, and inundations, &c. In almost every district there are portions which are out of the reach of artificial irrigation, and so are dependent on rain, and whole crops are often lost for want of it; but there are only a few kinds of crops (*e. g.*, gram) that are as a universal rule, left to the care of rain. "Moth," and other inferior pulses, are greatly dependent on rain.

Some crops will not grow without artificial irrigation, such as poppy, tobacco, and sugar-cane: the two latter crops, however, will grow without irrigation in low tracts near principal rivers. This is especially stated to be the case in the Ambálah district.

Rain generally falls twice in the year: in the cold weather it benefits the spring crops, and the regular "barsát," or rainy season, produces the autumn crop.

Rain falling in *Baisákh*, *Jéth*, and the first half of *Hár* (April, May, or early in June) is

* Mellville's Hushyarpúr Report.

† Major Clarke gives the following proportion of manure as given to crops per acre:—32 cart loads to wheat; 48 to poppy; 56 to tobacco; 40 to cotton and "makai" (maize); 48 to sugar-cane and turnips; and 32 to mustard.

* Cleghorn. Notes on the Vegetation of the Sutlej Valley, p. 7; also in the Journal of the Agri.-Hort. Soc. of India, Vol. XIII., p. 4.

injurious: but for the last half of *Hár* (June) it is good, and the land becomes "watar," or soft for the plough. After this, moderate rains in *Sáwun* (August and part of July) are good, and also in *Bhádon* (August, September); there is an amusing couplet well known to the agriculturists.

"Je mín píyá Diwáli,
Jiyá phús, jíya háli."

"If showers fall about the time of the Diwáli festival [what matter] whether you are lazy (lit. a 'bundle of sticks') or a reàl ploughman, [the crops are sure to be equally fine]."

If in *Assúh* (October) falls continue with cold winds, the pulse crops are injured. Rain falling after these crops have ripened, *i. e.*, after 15th *Kartak*, is bad, as it will be so late as to throw back the wheat sowings. Rain in *Maghar* (October and November), injures the ripe "kharíf," but helps the "rabí" crops. Rain, except slight showers, in *Phágan* is bad; it produces the red blight called "kúngi," and also rats.

With regard to the average rain-fall in the Punjab, I can only briefly here notice the valuable information obtained by Mr. E. A. Prinsep, Settlement Commissioner, who has prepared a map showing the various zones of the Punjab in which the average annual fall of rain is greater or less. An extract from Mr. Prinsep's letter, No. 233, dated 9th May, 1863, to the Financial Commissioner, was published, together with the Map, in the *Punjab Gazette*. The map contained the positions of no less than 150 stations, tehsils, and other localities, where the fall of rain is registered.

The results deducible from these observations are that the gradation of rain-fall are capable of being ranged into zones, which run parallel to the Himálayas. "It is worthy of remark," writes Mr. Prinsep, "how singularly the results of neighbouring stations agree one with another, in lines ranging from upwards of 70 inches in the Kangra valley (and even 105 at Dhurmsala), to 10 inches on the east of the Sutlej, 5 inches at Gugaira, and say 1 inch at Múltán, in the Bári Doab."

In the Bári Doab the difference of fertility is almost entirely owing to the difference of rain-fall.

Gurdaspúr district has above,	30 inches.
Amritsar, ...	20
Lahore, ...	10
Gugaira, ...	5
Múltán, ...	1

Of artificial irrigation, the sources are canals, wells, and "jalárs," or "chalárs." I will now briefly describe each.

Canals. — Although the construction of irrigation canals has long been practised by the various native dynasties, yet the finest works of this kind now in existence are owing to the British Government. There are districts, such as Jhang and others, which without the influence of canals and branch canals, would be deserts; although in many of these southern districts, there is nothing in the nature of the soil (excluding the "thals" or sandy desert tracts,) to prevent their being as fertile as the richest Doab. There are some canals still utilized which were cut and worked before the British rule commenced; such are numerous at Múltán,* where the indigo cultivation is almost wholly dependent on them. At present irrigation is effected by branch canals, called "rájbahá," leading from the main canals, from these again smaller water-courses, called khál or khúl lead to the fields to be irrigated. These are superintended by the officers in charge of the various divisions of canals, and their establishments—water-rates being paid by the land-owners.

Wells.—These are of two kinds—"kutcha" or "pucka." Kutcha wells are merely dug in the earth without masonry walls or

* In this district there are no less than fifteen canals, of an aggregate length of 325 miles, the largest of which are from 6 to 7 feet deep, and from 20 to 30 feet wide, and the smallest from 2 to 5 feet deep, and from 6 to 10 feet wide.—*First Report on the Administration of the Punjab.*

casing. In some kinds of soil they do very well, where the clay is strong and tenacious; but in other places, especially in the low khádir lands, they soon fall in. In some districts they are worked by a rude kind of Persian wheel, just as a pucka well is. In others, especially in the Cis-Sutlej districts, the water is raised by means of a lever or balanced pole erected over the well; one arm of the lever carries a large earthern "garha," or vessel holding about six gallons, which is let down into the well and raised again by a person pulling down the other arm of the lever; this apparatus is called a "dhenkli." It is the most laborious and least productive of all methods of irrigation. The men's hands often get cut by lowering and raising the "garha."

In khádir lands the depth before water is reached varies for 6 to 20 feet, but in high bángar lands it is much more, varying from 20 to 60: the water is abundant, but is procured with great labor; the dhenkli is not employed for a very deep well. An apparatus called the "lao charsa," or "rope and bucket" is also in vogue in raising well water: it consists of a large leathern bucket, "charsa," made of the hide of an entire bullock, which is attached to a rope, "lao;" this descends into the well over a small broad edged wheel, which works between the prongs of a forked pole—a branch of a tree fixed into the soil at the mouth of the well. This is commonly used in the Ambálah division, and though it is everywhere to be seen (worked by hand) at wells whence water is obtained for domestic purposes, it is little, or at all used in the Punjab proper for irrigation. The "lao charsa" in the Cis-Sutlej is worked by bullocks. Mr. Wynyard describes it as follows *:—

"Two pairs of bullocks are employed to each *charsa* a day. Wells are sometimes worked all day and all night. The labor at these wells is so valuable, that in the Thaneysur district, a bullock shares even with a man in the produce of a shared field; thus, if a field belongs to two men, and one has two bullocks he gets three shares, a man with four bullocks gets five shares. The yield in this watered bángar land, is greater than in the watered khadír lands. The action of the river on khadír lands appears to weaken the land by the sand which it deposits."

Pucka wells are those which have an internal wall of masonry, and a pucka coping; sometimes this is expanded into a chabutrá or flat terrace, on which the villagers sit, when they gather together for a sale or any discussion, or to rest after the day's labor and smoke their "hukas."

A notice of the native method of sinking wells belongs to the Engineering Department, and will be found under Section C.

Pucka wells are usually worked by the "harth," or Persian wheel. A broad edged lantern wheel whose axis lies horizontally over the centre of the well's mouth, carries on its broad edge a long belt of "moonj" rope, made like a rope ladder, the ends of which joined in an endless band reach below the surface of the water. To this at every step of the rope ladder, an earthern pot called "*tind*" is fixed. As the wheel revolves, the large rope belt descends into the water with its pots, the pots become filled with water, and are drawn up: as they reach the top of the wheel, they are by the revolution of the wheel inverted, and their contents poured out into a trough, which is ready to receive them, and which leads to the water-course of the fields to be irrigated. The wheel bearing the belt and waterpots is caused to revolve by having on the same axle another wheel parallel to it, and cogged in one side, the teeth of which work into the cogs of another vertical lantern wheel, whose axis again rests in a bar supported between two upright brick or wood pillars at one side of the well's mouth; this vertical wheel is turned by a pair of oxen yoked to a pole, which is fixed into the axis of the wheel in question. The oxen by walking round and

* Settlement Report Ambálah District, p. 371.

round on a tramway drag the pole with them, and cause the whole apparatus to turn.*

Sometimes over large wells there are two sets of wheels bearing the belt and pots as described, and placed parallel to each other. The well is then called "domálah," or in Punjabí dohartha, or do-chúthí. The single wheel well is called "ek-hartha."

These wells are often the joint property of several owners, who take it in turns to work them.

A "well" when spoken of by a native agriculturist, means not only the well but the land to which it is attached also.

In the Jhilam district however the "well" is something quite unlike the deep well of the other districts with its Persian wheel. It consists merely of a small pit in the low land by the side of a ravine. Each has only 2 or 3 acres attached to it but the ground is kept highly manured, and tilled like a garden, and all sorts of vegetables are raised; wheat is but little grown except to be cut green, as "khavíd." Tará-mirá is grown on the high earthen banks between the fields, thus utilizing what would otherwise be barren wastes.†

The irrigation of the districts in which brine pits abound, and where the water is not unfrequently brackish, is so peculiar that my sketch of the irrigation system would be incomplete without a reference to it. The following extract describes the wells of perganah Rewari, in the salt producing district of Gurgaon:—

There are four kinds of water found in the Rewari wells, all of which are used in irrigation; but the produce of each varies.

The *first* is "shírín or míthá," the irrigation from which in common seasons, does not produce such remarkably fine crops as the other kinds; but this is infinitely more than compensated by the fact that, in drought years the produce is certain and abundant.

Second. "Matwállah," or hard water: the land irrigated by which produces very fine crops except in drought years, when they are rather inferior, though still good and certain. Matwállah is composed of a large portion of sweet and a small portion of salt water.

Third. "Malmalla," or brackish water, with which good crops but inferior vegetables are produced, in common years. In drought however both are inferior.

Fourth. "Kharí shor," or very brackish water; this irrigation is said to bear finer and more abundant produce than the others. In a drought, however, the crops utterly fail, from the seed being burnt up in the ground. In the present season land thus irrigated was covered with a coating of salt resembling hoar frost, without a blade of any crop. Should it, however, happen that rainfall shortly after the seed is sown, the noxious quality of the salt is corrected, and that land yields produce. In no season is tobacco or any kind of vegetable grown, nor will man or beast drink of this water.

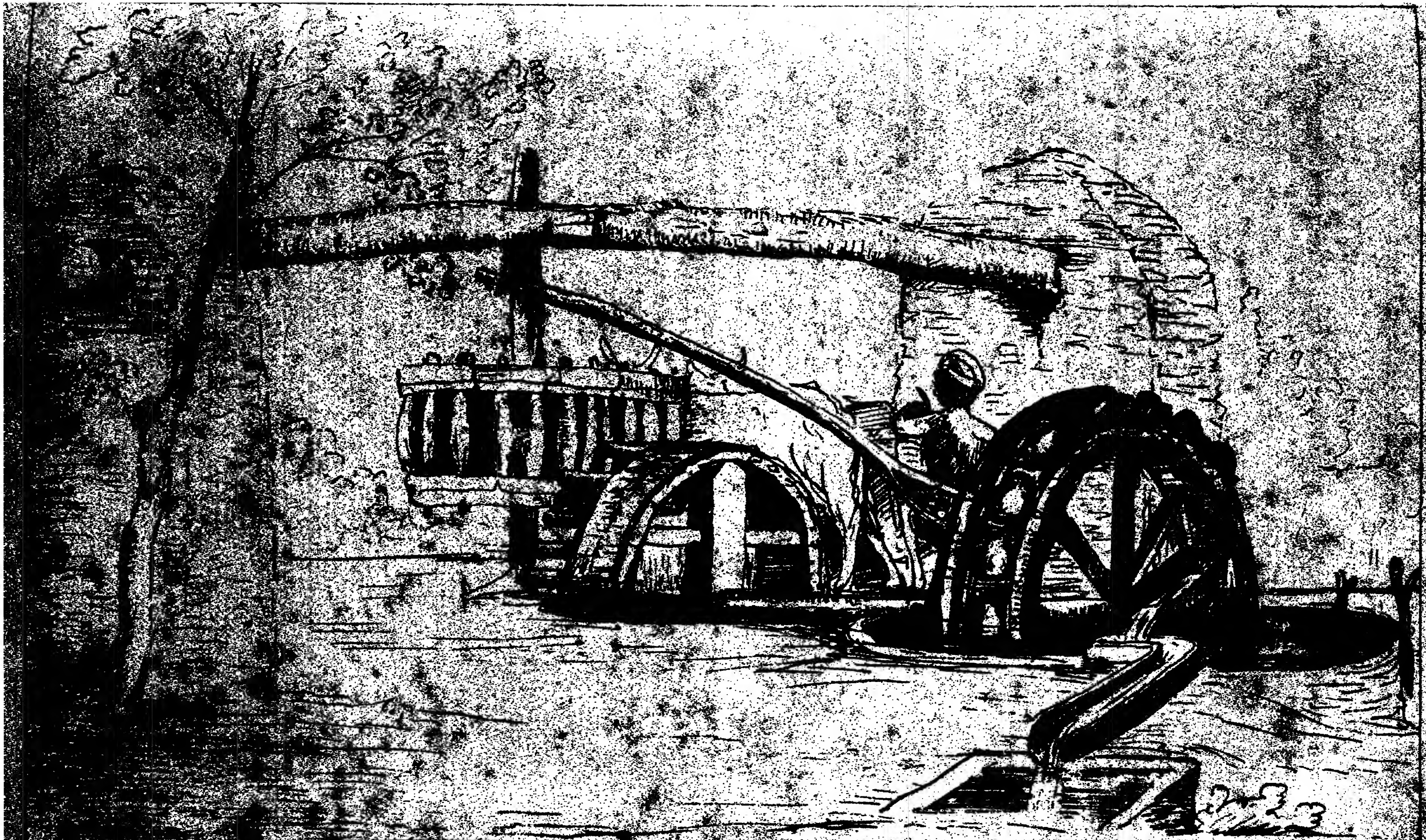
The area watered by a well in the Cis-Sutlej States, is shown in the following statement, deduced from Mr. Wynyard's Tables:—

Kind of well.	In a day. In acres, roods, poles, &c.	In the season.
	R. P. R. P.	
Pucka well worked by "charsa,"	From 1-15 to 3-5	From 3 to 12½ acres.
Do. do. Persian wheel, ..	From 0-30 to 2-10	From 3 to 6¼ acres.
Kutcha, worked with "dhenkli,"* ..	From 0-7½ to 1-20	From 1 acre 35 poles, to 3 acres.
Do. Persian wheel,	From 0-15 to 1-35	From 2 to 3 acres.

* I have added an illustration to make this description intelligible.

† Brandreth's Settlement Report, Jhilam.

* The "dhenkli" is seldom used in the Punjab proper, except for the irrigation of rice fields, and in river tracts for melons and tobacco.



Persian Wheel. for page 208

In the Ambálah district, with a Persian wheel, $7\frac{1}{2}$ acres is about the extent which can ordinarily be irrigated in a season. In the Charkari Mahál of Sealkot and Gujranwalla, 20 to even 30 acres will be watered in a season, but then 6 yoke of oxen are employed, and the well works night and day.

Major Clarke gives the average in the Rechna Doab thus :—A wheel worked night and day, with 6 pair of cattle, waters from three quarters to one acre. "Maira" land takes a larger quantity of water.

I cannot more clearly describe the method of irrigation adopted, than in the words of Major Clarke. He writes thus :*—

"The well used for irrigation is worked by the Persian wheel ; it is to be found in all soils from the "khádir" to the "bar." The cost of sinking a well ranges from 50 to 300 rupees,† and is dependent greatly on the depth of the water from the surface. A first rate (kámil) well, has forty acres of land attached to it, and should be worked by eight pairs of bullocks : in general, however, there are not more than four pairs, except in the bar, where every good well has at least six pairs. The condition of a well is almost universally estimated by the number of yokes attached to it, and no well with less than four yokes is considered worth much.

"The arrangements of watering are dependent on the number of shares, each share having a stated period allotted to it, called "varee."‡ If there are only three shares in a well, then the "varee" will extend to eight watches—24 hours : if four shares and upwards, the period allotted to the varee is four watches or 12 hours. The varee of 12 hours is by far the most common, especially in "bár" estates. In these there are generally 4 "varees," in the bángar often 6, whilst in the khádir we find 8 and 10 "varees." In the khádir one yoke of bullocks will work for two watches, consequently 2 yokes will work a varee ; whilst in the bár one yoke cannot work more than one watch, so that four yokes are required to work a varee of four watches.

"The amount of land irrigated by a well depends on the nature of the soil, depth of water from the surface, and condition of the well ; but most of all on the number of yokes it is worked by. A "kámil" well with 8 yokes, worked day and night, will irrigate 40 acres of land. This however cannot be reckoned on with certainty, and I should say 30 acres is the average in ordinary years, whilst in years of scarcity or drought, not more than 20 or 25 acres can be calculated on. In bar land, one yoke is equal to irrigating 5 acres in the year, whilst in the bángar land and khádir it reaches 7 or 8 acres. The soils of the khádir and bángar tracts however absorb more water than that of the bár. Buffaloes are mostly used in the "bár." They are also coming into use in the bángar lands, but in the khádir inferior bullocks can do the work. Buffaloes are superior in strength to bullocks ; but cannot work in the sun so well. The expenses of irrigation are least in the khádir, and greatest in the bár ; in the latter the water is often so far from the surface, that it is by no means uncommon to see two yokes of buffaloes working together at one well."

The last kind of irrigation mentioned was by jhalár (or chalár). It is used only in such localities as exhibit the pecularities to which this method is adapted.

"A 'chalár,' is merely the Persian wheel of a common well transferred to the bank of a canal, the margin of a jheel, or the high bank of a river. A small pool is excavated immediately below the chalár to collect the water, and afford the wheels a sufficient surface to work upon. As almost the whole expense consists in the wood work, chalárs are constructed in great numbers, and abandoned again without materially affecting the prosperity of the zemindars."

In some places there is a modification of this called a "raota" or "phiraoti," when there is only a wheel fitted with the belt and jars, and a man located on the bank turns the wheel with his foot, tread mill fashion, and aids with his hands also.

III. Classes of Cultivators.

The present survey will by no means admit of anything like an ethnographical essay ; but the habits of the different farming classes are so very different, as regards the care and energy exhibited in the processes of agriculture, that I should omit a very important cause influencing the state

* Agriculture of the Rechna Doab. Selections from Correspondence of Government of Punjab. Volume II.

† In many places a well costs more than double this sum.

‡ Equal to the Hindústání "bari," a turn.

of cultivation and the productiveness of districts, were I to pass this subject over wholly without notice. Mr. Brandreth justly remarks that the energy of the cultivator has much more to do with success, than the possession of the best soils, and the easiest modes of irrigation.

The following extract will show how large the class of agriculturists is in the Punjab.

"The proportion of agriculturists to total population is 56 per cent. The corresponding percentage in the North Western Provinces is 64. The proportions in both cases should however be greater, than that actually shown. More than half the population is certainly agricultural. It is probable that three-fourths subsist on agriculture, and if the returns had been strictly rendered, according to the prescribed definition,—namely, that all persons deriving any part of their subsistence from the land should be classed as agricultural, then not less than four-fifths of the population would have been returned as agriculturists."*

The most industrious classes are the "Ráíns," "Sainís," "Lubánás," and "Jats." The Ráíns besides their grain crops, are great growers of vegetables—such as melons, pumkins, and gourds of sorts, "baiṅgan" (*Solanum melongena*), "múlí," "ghúyáṅ" (*Arum colocasia*), and others. They are diligent, persevering men, and will often succeed in producing on good land, three or four successive crops of vegetables. There is a caste of *Mális* very similar in industry. The Sainís are a class found in sub-montane tracts, whose villages are always in a high state of tillage, as a rule they are great growers of sugar-cane. There is also a race of traders called Lubáná (in some places Brinjara), who settle down as agriculturists on waste tracts, and are known to be very careful and thrifty cultivators. There are numerous colonies of them along the right bank of the Rávi.

The Jats are conspicuous for their industry, they are not such great vegetable growers as the others; but their well fenced, and well worked fields are always known from the slovenly and ill-cared for lands of Gújars and Bráhmans. The wife of the Jat works cheerfully in the field with him in every kind of agricultural labor; not so the Rájput's wife, who does nothing but spin cotton and cook for the family.

Next to Ráíns, Mális, Sainís and Jats, rank the castes of Syads, Patháns, Banjáras, Bráhmans, Gújars and Ráṅgars, placed in the order of increasing slothfulness, while last and worst is the Rájput. The latter considers ploughing an occupation beneath his dignity, and it is only necessity that drives him to cultivate at all: he will never plough his land himself, as long as he can get any Chamár, or low caste man to do it for him.

In border districts of the North West frontier where hill tribes prevail, agriculture is generally at a discount. The Biluchí tribes are indolent: they sow the seed and take little or no care after it, leaving it to the course of nature, to produce some how or other their yearly crop. At the same time it must be confessed that not a few of the wild tribes who formerly lived as marauders and freebooters, have since the British rule began, settled down to agricultural occupations, and the tendency towards the increase of agriculture is a very marked result of the establishment of British Government. From these considerations it becomes obvious that the productiveness of a given area of land, will very much vary according to the class of people who cultivate it.

A Zemindar who is rich enough to cultivate without the aid of a loan from the "Shahukárs," or money lenders, at sowing time, is likely to be a much more thriving farmer, than others who, as is only too often the case, are dependent on such a loan to

* *Indian Records, No. XI.* Report on the Census taken on the 1st January, 1855, of the population of the Punjab Territories.

purchase the necessary seed,—and if there is delay, the sowing time passes, and the crop put down out of season is inferior. Unfortunately, these Shahukárs are still an established institution.

Owners of land frequently cultivate themselves with the help of "Kâmas," or laborers, who receive certain dues in grains, clothes, and money, according to the prevalent district custom. In some districts servants are of two classes—Mulázim and Ghair Mulázim, or Kamíń or Sepí. The class of "Mulázim" includes half year servants, ("chah mahidar,") and "dah mahidar." The latter often has a break in his service for *Baisák* month till *Hár;* and MAJOR CLARKE says, that his title is derived from this break of service of two months in a year, making him a 10 month ("*dah máh*") servant. A third kind of servant without a distinguishing title, is employed from 15th of *Hár* to the end of *Chet*. These men are all paid by so much wheat, so much money, together with their shoes, blankets for the cold season, and tobacco—the rates varying for each kind of servant. The *Ghair Mulázim* or Sepí, are a kind of workmen to be found in every village, who work for all, without being the servants (mulázim) of any one in particular. These go with the farmer to sow the field, and do other agricultural duties: their caste and names being descriptive of the proper trade to which they are brought up. There are the Kumhár (potter); *Tirkhân* (carpenter); the Chûra, or "*Khák-rob*" (scavenger or sweeper); and the *Mochí* (leather maker and cobbler). Besides specific payment for any work they do, they get certain payments and allowance of grains and pice. But the owners often do not cultivate; their land is given out on a "cultivating lease," as it were, to Paikáshts or cultivators, of other villages who take the produce, giving a share, with something extra as "Biswí" "ser," or five seers in the maund, as rent or "Malíkáná," to the owner. These cultivators are tenants-at-will, but there is a curious and somewhat anomalous institution, which if not the creation of the British rule, is at any rate chiefly maintained by our present system. This is a class of hereditary cultivators, persons who at the commencement of our rule were assumed to have the *right* to cultivate certain lands, though they were not the owners. They received fields from the owners, they paid Malíkáná like the others, they often did menial services, entered into mutual agreements, even had their fields changed, and yet under the present revenue system *cannot* be turned off as the other class can, on notice of ejection duly given. That such rights (as far as there could be any *rights* properly so called under former native dynasties), did exist in parts of the N. W. Provinces, there can be little doubt; but whether such rights existed in the Punjab and in other parts as an ancient rule, and whether any ancient practice sanctions the adjudication (as at present allowed) of these rights in favor of a tenant of more than 12 continuous years, may reasonably be questioned. It is, however, impossible at this place to extend our argument to the more detailed consideration of this interesting subject, and I would dismiss it with this notice, leaving it to those interested to study the subject *per se*.

IV. METHOD OF SOWING, WEEDING, AND GENERAL TREATMENT OF CROPS.

The great harvests are called universally *Rabí* and *Kharíf*, or by the villagers "Hárí" and "Sáwáni," from the names of the months in which the crops are ripe.

Rabí is the spring harvest; kharíf the autumn; but it is not all land that bears two harvests. Land that will, is called "do-faslí;" and land that only bears once, "ek-faslí;" but there are certain tracts of country where two or even three harvests will be taken off the soil.

The spring crops are the important ones,

for they are sown just at the great rain-fall of the year—the "barsát" or rainy season—about the month of September, and the crop which has been sustained during its growth by the winter or latter rains is cut at the end of the spring of the year following in the month of Bysákh, and the months following. In the bángar lands of the Cis-Sutlej States, Mr. Wynyard writes, that the rabí crops are not sown where artificial irrigation is not procurable, and that the autumn crops are the staple. The kharíf or autumn crops are sown before the rains, and reaped after their close in October and November.

Mr. Melville writing from Hushyárpúr says—

"The rabí crop is reared after great labor; the kharíf with but little trouble, the latter invariably follows the former, and the ploughings of the rabí are almost sufficient for the kharíf also. When the spring crop is cut, the husbandman will wait for a shower in June, plough over his land once or twice, and sow his kharif crop."

Fallow lands are never turned up for the first crop at kharíf; but always begin with a ploughing and sowing for the rabí harvest. The principal crops of the rabí are—wheat, barley, gram, "mattar" (*Vicia*), lentils, tobacco, linseed, ("sarshaf" or "sarsoñ," "rai," &c.) The kharíf sowings are "jawár," bájrá (millet), maize, rice, "moth," "múng," "másh," and other pulses, sugar-cane, and cotton. These are produced by the efficacy of the rains, which occur when they are in full growth. These crops require much moisture, and most of them, except the pulses, get artifical irrigation beside the rain. The land is subjected to repeated ploughings. The number of them depending on the industry and the means of the farmer; but their number seems much to influence the success of the crop. The fields to be sown with the (zabti) best crops, are often ploughed over and over again, ten and twelve times; six times is about the average. The plough seldom goes deeper than 6 inches, while in England 9 inches depth is considered to give the the best crops.*

Land intended for sugar-cane receives the greatest number. The land intended for this crop is ploughed up as if the land were to be sown for a rabí crop, and then left till *Har*. when the planting is effected.

Annexed is a Table showing the number of ploughings given to each kind of crop.

Crop.	Number of ploughings in *rohi* land.	Do. *dushahi* land.	Do. *maira* land.	Remarks.
	Rabi.			The number of ploughings will vary much with the skill, industry and means of the cultivator.
Wheat, ...	12	11	10	
Gújí (wheat and barley together),	7	7	5	
Barley, ...	5	5	4	
Gram, ...	2	2	2	
Poppy, ...	10	9	9	
Tobacco, ...	9	9	9	
Linseed, ...	12	12	11	
	Kharif.			
Makai (maize), ..	7	6	6	
Cotton, ...	5	5	5	
Mustard, ...	7	7	7	
Sugar-cane, ...	11 to 27	11	11 to 27	
Chari (jowár grown as a fodder),	2	2	2	
Dhán (rice), ...	4	..	..	
Munjí (rice), ...	5	..	..	
Moth, .. } pulses,	..	..	1	
Múng and Másh, .. } pulses,	..	..	2	

It will be observed how much fewer are the kharíf ploughings than the rabí, with the single exception of sugar-cane land, which however is no real exception, for this land as before remarked, is prepared at the same time as the rabí lands, but left to lie till the kharíf sowing time.

A pair of good bullocks will plough half an acre daily, but weak ones less. Cattle are never kept at work continuously for more than 5 hours in a day, or 2½ at a sugar mill. Generally speaking, there is in "bángar"

* Sealkote Report, p. 116.

lands about one pair of bullocks to 7 or 8 acres. "Bár" lands, where the wells are deep, take one pair to 5 acres, and buffaloes are there much in use on account of their strength. In the well lands it is said that the animals die off quickly because of the constantly rotatory motion which they undergo at the well. "Khádir" land requires less, and weaker animals will do.* In submontane and hill villages a pair can be purchased for Rs. 16, sufficient for ordinary ploughing purposes.

Land after being ploughed is levelled with a "sohága," called "dáb" in the submontane districts; a flat straight heavy piece of wood dragged over the surface of the field by cattle. Sometimes they are made with teeth, and called "much." Some crops are then sown broad-cast, and after the seed is down the land is twice ploughed over, and the field marked out into beds or divisions for irrigation purposes, the divisions being little banks of earth dividing the field into squares. The exact time for sowing is dependent on considerations of weather, rains, &c., and varies for different crops; the people are also superstitious, and often consult Múllahs and Bráhmans, according as they are Hindús or Mussulmáns, to ascertain favorable omens and times for sowing. Sowing is generally done broad-cast, but in khádir lowland along the banks of rivers, it is effected by the drill: a hollow piece of bamboo is attached to the plough through which seed is dropped, and the ploughing and sowing are thus done at one operation; but this practice is not followed in lands irrigated by wells ("*chahi*"). Sowing, when broad-cast is performed by the farmer, with the aid of the "Kamínañ,"—the Tirkhán, Lohár, and Chamár, &c., who receive certain dues for their work.

Reaping is done by laborers, who are paid either so much per "kanál" of wheat cut, or else so much per diem.

Manuring is done by Chúras (low caste of sweepers), who receive a small due, and the gleanings of the gathered grain.

Cotton is usually sown broad-cast like wheat. Poppy, tobacco, rice, and some other crops, are sown in nursery beds, called "lab," and when the seedlings appear are planted out. Sugar-cane grows from pieces of the cane containing some joints. They are put into furrows made in the soil.

In sowing, the quantity of seed required to one acre is proximately given in the following Table.

Each kind of crop has generally some peculiarity as to its management, or the method of sowing and rearing it, such details will be noticed in the catalogue along with the name of the particular product to which they refer.

Statement of the average quantity of seed required for one acre of land.

Description of crop.	Maunds.	Seers.	Chittaks.	Remarks.
Wheat, ...	1	10	...	*Sailábi* land requires less seed than *chahi* land.
Goji, ...	1	10	...	
Barley, ...	1	10	...	
Gram, ...	...	20	...	
Poppy, ...	...	...	7	
Linseed, ...	...	14	...	
Tará míra, ...	...	15	...	
Moth, mong & mash,	...	2	8	
Munji (rice), ...	...	12	...	
Chari, ...	...	20	...	
Makai (Indian corn),	...	9	...	
Cotton, ...	...	8	...	
Mustard, ...	...	3	...	
Turnip, ...	...	2	8	

When the crop is sown, the number of waterings that it receives greatly depends on the district, the fall of rain, and other natural and local circumstances.

Hand-hoeing and weeding are often given to crops. The operation is called "godí," and is effected by a flat kind of shovel or hand-hoe, "rambha," very like the "khurpa" of Hindústán; but much depends on the class of cultivators, and these operations are little

* Major Clarke's "Agriculture of the Rechna Doab."

attended to by the lazier castes of agriculturists before-mentioned. In the Cis-Sutlej districts, weeding appears to be much more attended to than in the others. In Thanesar, it is stated that sugar-cane is weeded 10 times; the poppy 7; tobacco 5; cotton 4; and maize 3. Sugar-cane, cotton, Indian corn and tobacco, and even rice require manuring.

The following statement indicating the ploughings, waterings, sowing time and reaping time of the various crops, has been compiled from the valuable Tables given by Major Clarke, in his account of the Rechna Doab Agriculture; the list applies directly to the Gujranwalla district, but gives a good general idea of the practice and results of the various operations of agriculture in other similarly situated districts of the Punjab proper.

RABI.

Kind of crop.	No. of ploughing.	No. of waterings.	No. of hand-hoeings.	When sown.	When reaped.
Wheat, ...	4 to 8	4 to 8	None.	Rabi, Kartik and Maghar.	Bysákh.
Barley, ..	4 to 8	4 to 8	Ditto.	Ditto.	Chet.
Goji, ...	4 to 8	4 to 8	Ditto.	Ditto.	Bysákh.
Gram, ...	2	None	Ditto.	Bhadon.	Bysákh.
Flax or linseed,	2	Sown in Sailábi.	Ditto.	Assuh.	Bysákh.
Mustard,	8	3 to 4	1	Assuh.	Chet.
China. ...	6 Rabi 4 Kharif	10 to 16	None.	Phágan and Sáwan.	Bysákh, Kartik or Maghar.
Kangni,	5, 6 to 7	5 to 6	1	Chet, Sawan and Bhádon.	Bhádon, Assuh.
Tobacco,	4 or 5	15	3 to 5	Kartik, transplanted in Magh or Phagan.	Jeth and Hár.
Onion, ...	4 to 8	16	3	Planted out in Mágh.	Ditto.
Carrot, ...	4 to 6	3 to 4	None.	Assuh.	Chet.
Turnip, ...	5	3 to 5	Ditto.	20th Bhadon to 10th of Assuh.	Maghar to Mágh.
Methi and sinji, ...	...	2 to 3	Ditto.	Kartik.	Phágan and Chet.
Poppy, ...	10 or 12	Every 4th or 5th day.	10 or 12	Assuh.	Chet.

It must be borne in mind that the rea[l] number of ploughings for some of the abov[e] crops is more than appears in the Statement because no account is taken of the primar[y] ploughings on wheat lands afterwards appro[-]priated to the other crops, which land lie[s] fallow till it is determined what shall b[e] sown.

KHARIF.

Kind of crops.	No of ploughings.	No. of waterings.	No. of hand-hoeings.	When sown.	When reaped.
Sugar-cane.	14 to 15	16 to 25	4 to 6	Phágan.	Maghar.
Cotton, ...	4 to 6	Uncertain.	4	15th Hár to 15th Sáwan.	Assuh to end of Maghar.
Maize, ...	3 or 4	6 or 7 in chahi lands.	2	Hár.	Assuh or Kartik.
Jawár. ...	3 or 4	3 to 4	For corn once.	Hár.	Kartik.
Bájra, ...	2	2 or 3	1	Sáwan.	Assuh or Kartik.
Moth, ...	1	None.	None.	Sáwan and Bhádon.	Maghar.
Múng, ...	2	Ditto.	Ditto.	Hár.	Maghar.
Til, ...	2	Ditto.	Ditto.	Sáwan.	Maghar.
Másh, ..	3	Ditto.	Ditto.	Sáwan.	Kartik and Maghar.
Rawán, ...	3	Ditto.	Ditto.	Hár & later.	Kartik.
Rice, ...	*Vide* details of cultivation in the sequel unde[r] "rice."				
Sawánk,...	2	3 to 4	None.	Hár & later.	Bhádon, Assuh and Kartik.
Mustard,	5 to 6	5 to 6	1 to 2	Bhádon.	Kartik.

Lands are generally manured at about 250 maunds per acre, or nearly nine tons. 12 tons is rather a low rate in England.

V. Produce.

I now come to the last head—namely,

the productiveness of the land, and the costs and profits of cultivation.

The produce per acre in the various districts may be best gathered from a tabular statement from all districts,—such a one now follows:—It was compiled from returns supplied to the Lahore Museum in 1860. The rates vary much; but we must bear in mind that the estimate is only a proximate one; and that the differences of local situation, the facilities of irrigation, the absence of presence of "kalr" in the soil, the character and caste of the agriculturists, the prosperity of the district generally, the moderation and justness of the Government assessment (amounting on an average to a third or a fourth of the estimated produce),* the definition and security of proprietary rights, have all of them great power to modify the agricultural prosperity of a district, and consequently to affect the area of land brought under cultivation, as well as the style of cultivation, and amount of produce.

* or to one-sixth in fairly lightly assessed tracts.

Division.	District.	Name of grain, &c.		Produce in grain per acre.	Produce in straw.	Average height of crops.
Lahore.	Lahore.	The particulars are given in a separate and detailed Table.				
				mds.	mds.	ft. in.
	Gujranwalla.	Wheat,	Khádir lands, ..	8	..	..
			Near the bar, ..	10	..	..
			On the bar, ..	14	..	..
		Barley,	Khádir, ..	7½	..	..
			Bar, ...	9 to 12	..	..
			Sailábí, ..	6	..	..
Amritsar.	Amritsar.	Wheat, white (on rohi land), ..		16	12	3-6
		Barley (on dosháhi land),		12	9½	2-0
		Red wheat (on rohi land),		16	10	2-6
		Chola (gram) ditto, ..		14	2	1-3
		Saroñ, ditto, ..		9½	..	3-0
	Sealkote.	Vadának wheat (1st quality), ..		15	12	4-6
		Red wheat, "lál kanak," ..		12	10	4-0
		Barley, ..		0	9	4-0
		White wheat, from Adálatgarh, ..		10½	..	..
		Ditto, from Syjoké, ..		18	..	..
		Rice, from Chukrandás, ..		?12	.	..
		Ditto, from Síráñwalla, ..		8¼	..	..
		Ditto, from Bakupúr of Pasroor, ..		8¼	..	..
	Gurdaspúr.	Mustard seed, ..		2¾	..	..
		Sugar, ..		3½	..	..
		Rice, ..		10½	..	..
		Wheat, ..		7	..	..
		Linseed, ..		2⅛	..	..
		Taramira, ..		3½	..	..

Division.	District.	Name of grain, &c.		Produce in grain per acres.	Produce in straw.	Average height of crops.
Rawalpindi.	Gujrát.	Wheat, kanak dágar, of 1st quality, ..	Rohi,	22	8¾	..
			Dosháhi,	18¾	8¼	..
			Maira,	15	8	..
		Ditto, of 2nd quality, ..	Rohi,	17½	8	..
			Dosháhi,	16½	7¾	..
			Maira,	15	7¾	..
		Red wheat "lál kanak" (of 1st quality), ..	Rohi,	18	8¼	..
			Dosháhi,	16½	8	..
			Maira,	15	8¼	..
		Ditto (of 2nd quality), ..	Rohi,	17	8	..
			Dosháhi,	16	8	..
			Maira,	15	7¾	..
		"Ghoni kanak" (of 1st quality), ..	Rohi,	13¼	6	..
			Dosháhi,	12	6	..
			Maira,	11	6	..
		Ditto (of 2nd quality), ..	Rohi,	12	6	..
			Dosháhi,	11	6	..
			Maira,	10	5¾	..
		Barley, "jau" (of 2nd quality),	Rohi,	14	3¼	..
			Dosháhi,	13	3	..
		Gram, ..	.. ..	8¾	..	..
		Rice (cháwal),	.. ..	14	..	..
		Maize (makkai),	.. ..	10½	..	..
		"Jawár" (*Holcus sorghum*),		7	..	..
		Bajra (*Penicillaria spicata*),		8¾	..	..
		Dálmúng (*Ph. mungo*), ..		7	..	..
		Ditto, massúr (lentil), ..		7	..	..
		Dal másh, or úrad (*Ph. radiatus*), ..		7	..	..
		Mót kála (*Ph. aconitifolius*),		4	..	..
		Mót safaid (*Cyamopsis psoraloides*), ..		4	..	..
		Chalodra or mandal (*Eleusine coracana*), ..		5¼	..	..
		Kaiyúñ (black pulse), ..		3½	..	..
		Cheena (*Panicum miliaceum*), ..		7	..	..
		Dángrí (pulse), (*Cajanus*),		5¼	..	..
		Karam (pulse), (*Cajanus*),		5½	..	..
		Kodra, (*Paspalum scrobiculatum*), ..		5¼	..	..

Division.	District.	Name of grain, &c.	Produce in grain.	Produce in straw.	Average height of crops.
			mds.	mds.	ft. in.
RAWALPINDEE.	Shahpúr.	Millet (china), ..	12	..	..
		Ditto (kangní), (*P. italicum*), ..	11	..	..
		Ditto (sawánk)(*Oplismenum frumentaceum*),	5 or 6	..	..
		Ditto (bajra), ..	8	..	..
		Ditto (jawár), ..	9	..	..
		Pulse (másh), ..	7	..	..
		Múng, ..	6	..	..
		Massúr, ..	7	..	..
		Moth, ..	8	..	..
		Lobiya, ..	2	..	..
		Gram (chana), ..	10	..	..
PESHAWUR.	Kúhat.*	Wheat (kanak), of 1st quality, ..	34	32	5
		Ditto (of 2nd quality), ..	34	32	5
		Barley (jau), ..	48	60	3½
	Peshawur.	Barley (jau), ..	40	5	2½
	Hazara.†	Wheat (kanak), ..	5-8	..	..
		Barley (jau), ..	6-12	..	..
		Rice (cháwul), ..	8-12	..	..
		Oil seeds—sarshuf, ..	4	..	..
DERAJAT.	Dera Ghází Khán.	Wheat (kanak), ..	10½	..	..
		Ditto (makkewalla), ..	5¼	..	..
		Ditto (pamban), ..	7	..	..
		Barley (jau), ..	8¾	..	..
		Black barley, ..	8¾	..	..
		Rice, ..	12¼	..	..
		Ditto, ..	12¼	..	..
		Bajra, ..	10½	..	..
		Jawár, ..	10½	..	..

* Kúhat—I believe this and the Peshawur rate to be a mistake, unless the maunds are "kucha," from 13 to 20 seers instead of 40.

† The list given by MAJOR ABBOTT to the Agri-Horticultural Society of produce in Hazara (where the soil is classed according to the number of harvests it yields), is as follows:—

Name of grain.	Tin-fasli soil.	Do-fasli soil.		Ek-fasli soil.	
		mds.	srs.	mds.	srs.
Maize, ...	12 maunds, ...	8	0	6	0
Cotton, ..	2¼ maunds, ...	3	0	2	0
Rice, ...	" ...	...		12	0
Jawár, ...	" ...	4	0	...	
Kungni, ...	" ...	..		2	20
Bajra, ...	" ...	...		2	0
Mash, ...	" ...	...		1	8
Murg, ...	" ...	...		2	0
Moth, ...	" ..	...		2	0
Rawan, ...	Sown always with other grain, ...	...		2	0
Wheat, ...	4 maunds, 34 seers, ...	3	20	8	32
Barley, ..	9 maunds, ...	6	0	4	20

Division.	District.	Name of Grain, &c.	Produce in grain.	Produce in straw.	Average height of crops.
			mds.	mds.	ft. in.
DERAJAT.	Dera Ghází Khán.	Gram, ..	8¾	..	..
		Peas, ..	8¾	..	..
		Moth, ..	3½	..	..
		Dal (múng), ..	5¼	..	..
		Mohrí, ..	8¾	..	..
		Simuka, ..	3½	..	..
		Sawánk, ..	5¼	..	..
		Gram, ..	5¼	..	..
	Bunnoo.	Kangni, ..	6-10	7-16	3-4
		Barley, ..	8-16	6-14	2-3
		China, ..	9	8	12
MULTAN.	Múltán.	Wheat, ..	9	16	3
		Barley, ..	10	12	2
	Jhang.	Wheat (called rodí kanak), ..	12-19	10-17	2¾-¼
		Ditto (inferior land), ..	9-12	7½-10	2-2¼
		Wheat (canal land), ...	13-20	15-21	¼-33
		Ditto (inferior land), ..	10-13	8-15	2-2¼
		Barley (canal land), ..	12-24	8-16	2¼-3
		Ditto (inferior land), ..	6-10	4-6	2-2¼
JALANDHAR.	Jalandhar.	Wheat, Chahi, ..	10	..	..
		Wheat, Baráni, ..	4	..	..
		Barley, Cháhi, ..	11	..	..
		Barley, Baráni, ..	4	..	..
		Gram, ..	20	..	..
		Bajra, ..	4	..	..
		Maize, Chahi, ..	16	..	..
		Maize, Inferior, ..	8	..	..
		Charí (jawár), ..	5	..	..
		Mash, ..	8	..	..
	Hushyarpúr.	Wheat of 2nd quality, Chahi, ..	8	15	..
		Wheat of 2nd quality, Baráni, ..	6¼	10	..
		Wheat of 2nd quality, Best rohi,	12	22	..
		Ditto of 1st quality, Chahi, .	24	25	..
		Ditto of 1st quality, Baráni,	12	20	..
CIS-SUTLEJ STATES.	Amballa.	Wheat (rausli), ..	18	54	3
		Gram (khadír), ..	15	30	1½
		Linseed (khadir), ..	3	..	1½
		Lentils, ..	5	5	1¼
	Ludhiana.	Wheat, ..	16	..	..
		Rice, ..	14	..	..
		Barley, ..	14	..	..
		Maize, ..	19	..	..
		Jawár, ..	19	..	..
		Bajra, ..	13	..	..
		Gram, ..	19	..	..
		Moth, ..	66	..	..
		Másh, ..		..	..
		Múng, ..	10	..	..
		Sesamum (*til*), ..	6	..	..
		Sarsóń, ..	11	..	..

Division.	District.	Name of grain, &c.	Produce in grain per acre.	Produce in straw.	Average height of crops.
			mds.	mds.	ft. in.
Delhi.	Delhi.	Wheat, ..	6½–16	..	..
		Barley, ..	6–16	..	..
		Barley, on unirrigated land, ..	2–4	..	..
		Jowar, ..	5–10	..	..
		Rice, ..	9–15	..	..
		Gram, ..	6–14	..	..
		Gawár (*Cyamopsis*), ..	15–20	..	..
	Karnál.	Wheat, Irrigated best land, ..	13	15	3
		Wheat, Bángar, ..	7	7	2¾
		Wheat, Rausli, ..	9½	9½	2¾
		Barley, Irrigated best land, ..	12	12	2¾
		Barley, Bángar, ..	7	7	1½
		Barley, Khádir, ..	9½	9½	2
		Gram, Irrigated best land, ..	9½	6¼	2
		Gram, Bángar, ..	10	8	1½
		Gram, Khádir, ..	9½	9½	1
		Sarsoń, ..	5	5	4
Hissar.	Hissar.	Rice, the kind called básmátí, ..	12	..	..
		Rice (shakar chiní),	10	..	..
		Ditto (múnjí), ..	10	..	..
		Jawi or javi (oats), ..	15	..	..
		Jowar, ..	9	..	..
		Gram, ..	18	..	..
		Móth, guwár, mung, ..	9	..	..

Division.	District.	Name of grain, &c.	Produce in grain per acre.	Produce in straw.	Average height of crops.
			mds.	mds.	ft. in.
Hissar.	Rohtak.*	Daúdi wheat, ..	6–14	..	..
		Rice, ..	7–12	..	..
		Barley, ..	8–14	..	..
		Maize, ..	6–18	..	..
		Kanguí, ..	6–12	..	..
		Gram, ..	6–24	..	..
		Múng, ..	3–6	..	..
		Urd, ..	3–6	..	..
		Móth, ..	3	..	..

* More recently I have received from the Deputy Commissioner of Rohtak, under his letter No. 592, dated 18th August, 1864, the following Table, showing the produce in canal and rain irrigated villages.

	Average produce per pucka beegah of canal villages.	Average produce per pucka beegah of barani villages.
Wheat, ...	10 maunds.	7 maunds.
Paddy, ...	12 "	...
Barley, ...	12 "	5 "
Imphee, ...	6 "	7½ "
Indian corn, ...	7 "	8 "
Bajra, ...	6 "	10 "
Kangni, ...	7 "	2½ "
Gram, ...	12 "	10 "
Mung, ...	8 "	7 "
Urd, ...	8 "	7 "
Móth, ...	...	11 "
Goar, ...	...	12 "
Mustard or rape seed, ...	7 "	4 "
Til, ...	...	6 "
Goor, (molasses from sugar-cane, ...	18 "	...

One or two districts, from the peculiarities of the situation, or means of irrigation, could not conveniently be included in the above Table; they are given separately.

Such are the Sirsa and Kangra districts; the former remarkable for the irrigation effected by the overflow of the river Ghagar; the latter by its mountain streams and peculiar rice crops.

Produce of Sirsa.—I. Produce of Tract on the Bank of the Sutlej.

Local name of the grain or quality of the grain.	Whether grown with irrigation or not.	Average height of stem.	Soil in which grown.	Average yield per acre. Grain.	Average yield per acre. Straw.	Remarks as to outward appearance.
		feet.		md. sr.	md. sr.	
Kanak "paman" (wheat of large size, long grain, and translucent appearance), ...	By irrigation, ...	4½	Rausli and dakur,	10 0	15 0	Long and dark color beard.
Kanak "dáúdkháni" (wheat of very white color), ...	" ...	3	"	7 20	11 10	No beard at all; consumed chiefly by wealthy people.
Kanak, "lál" (wheat of smaller size, and reddish appearance),	" ...	3	"	9 0	13 20	Short & white beard.
Jau (barley,) ...	By irrigation and rain, ...	4	Rausli and bhoor,	12 0	12 0	Short beard and ear.

II. Produce of the Tract on the Bank of the Stream Ghagar.

Kanak, "lál" (wheat of small size, and reddish color),	By irrigation, ...	3	Rausli and dakur,	12 0	24 0	Long & white beard.
Jau (barley), ...	By irrigation and rain, ...	3	Rausli, dakur and bhoor, ...	12 0	12 0	Long beard and short ear.
Chola (gram), ...	By ditto, ...	1½	Dakur and rausli,	15 0	30 0	

III. By Rain.

Jau (barley), ...	By rain, ...	2¼	Rausli, ...	4 26	9 12	Long beard and ear.

Kangra District.

Crop.	Produce per acre.	Quantity of seed required for sowing.	Remarks.
Wheat, ...	7½ maunds,	26½ seers,	Principally in Kangra valley.
Barley, ...	6½ "	35 "	Grows also higher up on the mountains.
Maize, ...	8½ "	8 "	One return gives about 16 maunds an acre or ten maunds a beegah; perhaps this includes the cobs.
Rice, ...	14½ "	44 "	Mr. Barnes mentions that he has counted 1100 seeds on one head of rice. One return gives only 3½ maunds of husked rice, but that was a fine quality.
Amaranth (*Chaulai*), ...	4 "	...	
Mandal (*Eleusine*), ...	6 "	...	
Másh, ...	2 "	5½ seers,	Usually sown mixed with *kúlth*.
Gram, ...	9½ "	2 "	
Chínáñ, ...	4 "	...	Both Kúlú and Kangra.
Ginger, ...	4 "	...	

STATEMENT SHOWING THE QUANTITY OF THE SEVERAL SORTS OF GRAIN PRODUCED AT LAHORE.

Name of grain.	Time of sowing.	Number of times of ploughing.	Quantity of seed per acre.	Cost per acre.	Quantity of grain produced.	Remarks.
Wheat. ...	October. ...	7 or 8 times.	1 to $1\frac{1}{8}$ mds.	It does not need hoeing.	25 to 30 mds.	Abundantly produced in mahjah and kalr lands (high lands from the river), but very little near the Rávi banks; if sown there, the crop produces more grain.
Barley. ...	October. ...	4 to 5 times.	35 to 40 srs.	Ditto.	35 to 40 mds.	Kalr land produces more grain and less straw than the others. Barley is mostly used as a food for horses, and very little by the men of lower classes. It is made into sattu, or flour, made after parching the grain. The crop does not need hoeing. Barley parched is called *khat*, and with gram, *channa-chabina*.
Gram. ...	Sepr. & Octr.	2 or 3 times.	12 to 15 srs.	Ditto.	20 to 25 mds.	It is eatable when parched, and is used as dál (split gram); when ground into "besan" it is used for making sweetmeats. In its raw state it is food for horses.
Mustard, ...	October. ...	4 to 5 times.	10 to 12 chs.	It needs hoeing.	3 to 4 mds.	From its seeds oil is extracted, which is used for many purposes: the stalk is useless.
Masúr or lentils. ...	Ditto.	2 or 3 times.	25 to 28 srs.	It does not need hoeing.	15 to 20 mds.	It is used as dál, and is made into bread: the *bhúsa* answers well for the food of animals, and the grain is given to the bullocks.
Churál. ...	Ditto.	2 or 3 times.	Ditto.	Ditto.	Ditto.	Cooked as dál, its flour is baked into chapaties, and its stalk for cattle.
Linseed. ...	Sepr. & Octr.	5 or 6 times.	10 to 28 srs.	It needs hoeing twice.	Ditto.	If it is cultivated for its fibre, it is sown with 28 seers of seed to an acre, otherwise 10 seers is sufficient. If grown for oil its stalk is useless: the land is manured before sowing: the crop is watched.
Rice, of all descriptions. ...	May & June.	4 to 5 times.	12 to 15 srs.	Rs. 3-8.	35 to 40 mds.	Kalr land produces very good rice, but not so the mahjah land. It is a very wholesome food; from it are made sweetmeats, the flour is baked into chapaties. The straw is not so useful for fodder as the other straw, therefore its chief use is as a litter: the land in which it grows is manured: the crop is watched when standing green in the field.
Sesamum. ...	July. ...	3 or 4 times.	10 to 12 chs.	...	$2\frac{1}{2}$ to 3 mds.	It yields an oil and is used in making sweetmeats. Hindús on one of their fasts use it for food.
Jawár (*Holcus sorghum.*) ...	Ditto.	Ditto.	20 to 25 srs.	No need of hoeing.	...	When green answers well as fodder for cattle, and called "charri." The parched grain is eaten by the country people. Its flour is baked into chapaties.

Name of grain.	Time of sowing.	Number of times of ploughing.	Quantity of seed per acre.	Cost per acre.	Quantity of grain produced.	Remarks.
Másh. ...	July & Augt.	2 or 3 times.	5 to 8 seers.	No need of hoeing.	5 to 7mds.	It is used as dál, and mixed with rice, makes "kichri." In famine its flour is made into chapaties by the country people; also "baris" are made of it by soaking the grain in water for a night; next morning the soft grain is gently rubbed to remove the skin, it is next ground on a flat stone and mixed with spices, this paste is made into balls, which are put for a time in the sun till they dry.
Móth. ...	June & July.	2 or 3 times.	5 to 7 seers.	Ditto.	4 to 5 mds.	Dál and kichri is made of this, and very seldom chapaties of its flour.
Múngi. ...	July. ...	2 or 3 times.	3 to 4 seers.	Ditto.	7 to 8 mds.	Ditto, ditto, ditto.
Bajra. ...	June or July.	3 or 4 times.	3 to 4 seers.	Ditto.	8 to 9 mds.	The people when in need make bread of it and also kichri: it is food for birds; it is much eaten however in the tract or country called Phattowar, between the Jhilam and Indus.
Kangní. ...	Ditto.	2 seers.	1½ to 2 seers.	Ditto.	10 to 12 mds.	Ditto, ditto, ditto.
China. ...	Ditto.	2 seers.	2 to 2½ seers.	Ditto.	8 to 10 mds.	Ditto, ditto, ditto.
Sawánk. ...	Ditto.	4 seers.	2 to 2½ seers.	Ditto.	8 to 10 mds.	It is made into "khir" (grain and milk boiled together). Khushkah, gram boiled in water, kichri, &c.
Maize. ...	Ditto.	6 or 7 times.	28 to 30 seers.	Ditto.	40 maunds.	It is made into bread; the boiled grain is used for eating. It is generally parched and sold in bazar by people for eating, called "challi" and "sitta;" also it is used as dalya.
Mandal. ...	July. ...	2 or 3 times.	10 to 12 seers.	Ditto.	10 to 12 mds.	Useful for making bread, and is a sort of food for animals.
Kodra. ...	Do. ...	2 or 3 times.	10 to 12 seers.	Ditto.	10 to 12 mds.	Bread is made of it; also kichri,—grain and rice boiled in water.
Arve or gúyáñ,	Feb. & Mar.	8 or 10 times.	6 to 7 seers.	Rs. 18.	100 105 mds.	The root is used by Natives and Europeans as an article of food. It is procurable in every season of the year.
Potato. ...	October. ...	Fifteen times.	6 to 7 seers.	Rs. 25.	140 maunds.	Ditto, ditto, ditto.
Sugar-cane, ...	Feb. & Mar.	15 or 16 times.	Rs. 19.	Rs. 20.	150 maunds.	It is much esteemed by all classes, who chew it as a sweatmeat; the process of sugar-making is described later in the book.
Musk-melon, water-melon, &c.	Ditto.	12 or 14 times.	Rs. 3 to 4.	Rs. 15 or 16.	Rs. 37 or 63.	Esteemed as a fruit.
Cotton. ...	April & May.	5 or 6 times.	9 to 10 seers.	Rs. 12.	5 to 6 mds.	A fibre.
Red pepper. ...	Ditto.	5 or 6 times.	Rs2½.	Rs. 12.	Rs. 20.	When dry, the produce is about five maunds per acre.

It is now time to close this somewhat protracted agricultural sketch, with some tables illustrating the costs of cultivation and the profits of agriculture. I need hardly remind the reader that the Government assessment on lands is intended to be at the rate of about a fourth, and should not be more than one-sixth of the *gross* produce, ascertained at the time of settlement by careful enquiry, both as to existing assets and future capabilities. There can be little doubt that the majority of settlements are now on equitable terms, although it must be admitted that there is much inequality on the pressure of the assessments. The revision of settlement, at present in progress in many districts, cannot fail to remedy this defect to a great extent; and the security of a just and moderate assessment for a long period cannot fail to encourage agriculturists.* It has been said that, in some of the fertile districts of the Punjab, a portion of the kharíf harvest alone is sufficient to pay the Government share, leaving almost the entire rabí, as clear profit to the farmer, that is as his own assets from which he pays his costs and expenses, and draws his profit. There can be little doubt that this is the case, and in a state of profound peace, when the agriculturist knows that the sum once assessed cannot be augmented during the continuance of the term specified in his settlement contract, he has every inducement to enlarge his efforts, and thus surely increase his profits. It only remains for us to overcome the great drawbacks to improvement that exist in the slothfulness of the people, and where they are not slothful (as many agricultural tribes are not), to overcome that aversion to change which leads them to be perfectly satisfied to plod on at the same rate now as they did 2000 years ago. Suggestions on these points will be found on the report of the jury on this class. I will only add here that one of the most powerful checks on cultivation that is in existence consists in the taxation of capital in assessing lands. It requires the nicest discrimination on the part of the assessing officer, and ought to receive his earnest attention, to see that capital is not taxed, otherwise the people will cease bringing land under cultivation, and cease sinking wells from the mere dread of an enhanced rental, which if carelessly assessed according to mere *apparent assets*, will surely result in the crushing of agricultural enterprise.

I now give some lists showing the costs of cultivation in different parts. The first is a transcript of MAJOR CLARKE's estimate, which gives the costs and profits on 34 acres of land attached to a first rate well, in the perganah of Shekopúra in the Rechna Doab, which will give a fair representation of the majority of good lands in the Punjab, (excluding of course bar lands, and sandy, "tibba," tracts,) where the produce is assumed to be first rate in quantity.

The 34 acres sown for the year are supposed to be sown thus, 12 acres for kharíf, 22 for rabí:—

12 ACRES FOR KHARIF.
- 2 ghumaos of land for sugar-cane, or nearly 2 acres.
- 2 acres of cotton.
- 1 acre of rice.
- 1 acre of sarsoń (rape or mustard seed).
- 4 acres of jawár (*Holcus sorghum*).
- 2 acres of maize.

22 ACRES FOR RABI.
- 18 acres of wheat.
- 2 acres of barley.
- 2 acres of gújí (wheat and barley mixed).

Then the cost and profit will be as follows:—

* The question of a permanent settlement is also under discussion; the subject is one of the greatest importance, but cannot be entered on here, because if any remarks were offered either on one side or the other, it would be impossible to avoid going into the whole subject.

Quantity of land under crop.	Crop.	Produce in kind.	Produce in money.			Expenses, including revenue, and all cesses at $\frac{1}{6}$th of produce.			Expenses of ditto at $\frac{1}{3}$rd of produce.			Profit to cultivator or former paying $\frac{1}{6}$th of produce.			Ditto paying of $\frac{1}{3}$rd of produce.		
			RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.
2 acres, ...	Sugar-cane, ...	80 mds. (goor,)	200	...	...	149	9	...	163	3	6	50	7	...	36	12	...
2 „ ...	Cotton, ...	24 „ ...	48	...	...	34	9	6	39	2	6	13	6	6	8	13	6
2 „ ...	Maize, ...	40 „ ...	26	10	...	17	11	9	20	6	9	8	14	3	6	3	6
1 „ ...	Rice, ...	24 „ ...	24	...	...	13	9	9	15	14	6	10	6	3	8	1	6
1 „ ...	Mustard, ...	8 „ ...	8	...	...	4	8	...	5	3	9	3	8	...	2	12	3
4 „ ...	Jawár, ...	32 „ ...	21	5	...	22	3	...	Is used as fodder and the cost becomes almost nothing.								
12 „ ...	...	..	327	15	...	242	3	...	243	14	9	86	10	...	62	10	9
		Rabi.															
18 acres, ...	Wheat, ...	304 mds. ...	304	...	...	198	...	9	226	14	6	105	15	3	77	1	6
2 „ ...	Barley, ...	32 „ ...	21	5	3	11	14	6	14	1	3	9	6	9	7	4	...
2 „ ...	Gúji, ...	32 „ ...	25	10	...	14	8	...	16	14	6	11	2	...	8	11	6
22 Total, ..	...	...	350	15	3	224	7	3	257	14	3	126	8	...	93	1	...
	Grand Total, ...	...	678	14	3	466	10	3	501	13	...	213	2	...	155	11	9

I have added one more Table of the costs and profits of land, extracted from that very able and interesting volume, the Report on the Revised Settlement of the Sealkot District in 1865, by Mr. E. A. Prinsep. These tables are interesting from their great accuracy, as well as from their showing the state of things in a richly cultivated district like Sealkot. From the Appendix to these tables a very good idea will be obtained of the proportion in which the Government revenue tax falls on the produce, and how equitable rates can be ascertained: the tables as here given are somewhat reduced in form from the originals, which, together with the illustrative matter of para. 241, *et seq.*, should be studied in the original report; the whole work will repay perusal.

The land taken as a standard is 30 ghumaos, attached to one first class well in the Charkari Mahál, or well abounding tract of the district.

The total expenditure for a year from pucka well, irrigating 30 ghumaos, in the Charkari Mahál of Sealkot is:—

		R.	A.	P.
Wages of labor.	Ploughman, @ 2 maunds, kucha per mensem and 1 rupee cash, ...	22	0	0
	Coolie, per annum, ..	4	0	0
	Cowherd, ...	26	0	0
		52	0	0
Farm service.	Potter, @ 1 máni per harvest, ..	10	0	0
	Carpenter, @ ½ máni, ..	5	0	0
	Carpenter, @ ½ máni, ..	5	0	0
		20	0	0
Cost of fodder and keep of stock.	5 Yoke of oxen's feed, besides grass and clover, @ ¼ a máni per head per annum, or cash charge for salt, Rs. 2, ...	27	0	0

		R.	A.	P.
Repair of ploughs & tools.	5 Ploughs, @ Rs. 0-8 per plough, per annum, ..	2	8	0
	Iron for trowels *(rambha)* scythes *(dátri)*, &c., ..	1	0	0
	Ditto, for spades, ...	1	0	0
	Well rope, required every 2 months, @ Rs. 1 per "mál,"	3	0	0
		7	8	0
Value or cost of seed.	1 Ghumao sugar-cane; @ 1 pai per 4 marlahs, ...	6	0	0
	2 Do. cotton, @ 16 do., ..	0	4	0
	4 Do. maize, @ 1 topa per kanal, ...	2	0	0
		2	0	0
	4 Do., "charri," @ 3 do. do.,	2	8	0
	Total (Autumn crop), 12 *ghumaos*,	8	12	0
	10 Ghumaos wheat, @ 1 pai per kanal, ...	8	0	0
	4 Do. "guji," do., do., ..	4	0	0

		R.	A.	P.
Value or cost of seed.	2 Do. barley, @ 3 pai do., ..	2	0	0
	3 Do. turnips, @ 1 pai per ghumao, ...	1	0	0
	½ Do. flax, @ 1 pai per kanal,	0	3	0
	½ Poppy, @ Rs. 2 per ghumao,	0	1	0
	Total (Spring crop), 18 *ghumaos*,	15	6	0
	Grand total, Rs.,	130	8	0

NOTE.—One máni is equal to 12½ maunds kucha. A maund kucha is variable, from 13 to 20 seers, being usually counted 2½ kucha = 1 pucka; the standard maund is 40 seers of 80 tolahs each.

The standard maund is sometimes called, *pakka* or *Angrezi*, but more often the term *pakka* is applied to the "Lahori maund," the old weight which is rather heavier, viz., 3 kucha maunds = 1 Lahori.

Annual gross income for one pucka well, irrigating 30 ghumaos of land, in the Charkari Mahál, Sealkot district.

Harvest.	Area under crop, in ghumaos.	Usual distribution of crops.	Average yield per ghumao, in kucha maunds.	Average market price for 30 years (per rupee).	Yield in the deduced money equivalent.	Total value in money for whole crop.	Grand total value.
Autumn (kharíf), 12 ghumaos, at an average gross rate of Rs. 12-10,	2	Sugar-cane,	45	1½ maunds,	32	64	
	2	Cotton, . .	20	1¼ "	16	32	
	4	Maize, . .	24	2 "	12	48	
	4	"Charri," .	...	per ghumao,	2	8	152
Spring (rabí), 18 ghumaos, at an average gross rate of Rs. 17-9, . . .	10	Wheat, . .	30	2¼ maunds,	13-4	140	
	4	Guji, . .	35	3½ "	10	40	
	2	Barley, . .	40	4 "	10	20	
	1	Turnips (not counted, as consumed by cattle).					
	½	Flax, . .	10	2 "	5	5	
	½	Poppy, . .	...	per ghumao,	6	3	208
Grand total of the 30 ghumaos, for both harvests, ...							360

Space forbids me to extract from the Sealkot report the remaining Table, which fills up the page in the original, and which shows how an equitable revenue rate per well can be deduced from the above data. To summarize the results in the form of a percentage, it will be found that calculating the gross proceeds of 30 acres, at a money value of Rs. 360, this gives Rs. 12 an acre; and the following scheme will show the costs and

profits according as the Government revenue is assessed at Rs. 2-8 or at 2 per acre.

	At Rs. 2-8.			At Rs. 2-0.		
	RS.	A.	P.	RS.	A.	P.
Expenses,...	130	8	0	130	8	0
Subsistence, ...	100	0	0	100	0	0
Interest, &c., ...	17	10	0	15	8	0
Revenue and cesses, ...	85	8	0	68	6	0
Profits, ...	26	6	0	45	10	0
	Profit at 7 per cent.			Profit at 13 per cent.		

Where the Government revenue demand is at the rate of Rs. 2-8 per ghumao, the farm expenses and subsistence of two families are 64 per cent., interest on revenue and cash payments of farm, 5 per cent.; Government revenue, 23·5 per cent.; leaving nett profit, 7·4 per cent.: or if the Government rate be Rs. 2 per ghumao, then these figures will become 64 per cent., 4·2 per cent., 18·6 per cent.; and profits, 13·0, respectively.

Under the various headings of the collection will be found an occasional list of costs in detail of the cultivation of the various crops.

When the owner does not cultivate, but receives his malikana, the profit to him is nearly the same.

The last point I shall notice, is the native classification of diseases and blights incident to crops, and again quote Major Clarke,* and Mr. E. A. Prinsep.

Corn is lodged (hawá-zad) by strong wind, and is injured by want of rain, frost, hail, rats, jackals. The following are the names of insects, animals, and diseases which injure crops.

Sugar-cane.—Tela, huda, keeree, soka, pála, nisurna, moosh, kuchra, and kungeearee.

Cotton.—Phirtee, tela, soka, pála (frost) and rats.

Makai.—Keeree, toka, siyank, tupke.

Churee.—Keeree, toka and tela.

Rice.—Jholur and rats.

Moth, mung and *mash.*—Tela, toka, and bhutoth, or poachur.

Wheat, barley and *goojee.*—Koongee, lakha, jholur, patáka, toka and kungeearee, and trel.

A few of the above may be specifically mentioned.

Koongee.—A red rust. The "koongee," as far as I can discover, is a blight that comes upon young wheat (which is sown late) in the months of January and February, after much rain. If there has been several days of rain, and followed by a cessation for three or four days, and during this time the sun does not appear, but heavy lowering clouds, hanging about bringing sultry weather, then this red "rust" appears on the ears of wheat. The damp is said to bring it on, but it goes away if the sun shines after rain, or the cold wind ceases. It attacks wheat and nothing else, barley is quite free from it, because it is believed that barley is not a grain that is heating. Gram and mussoor, which are sown at this time as wheat are free from it; this "koongee" is the chief disease wheat is liable to. It appears always first at the junction of the large leaf, with the blade; and thus spreads to the young ear, if it should disappear in three days, then there is hope for the crop. If it lasts and spreads beyond that time, then the crop is ruined, generally it reduces the yield by about one-third; sometimes by half; the disease lasts altogether about ten days, and when in its height so extensive is the "red rust" that is accumulated, that if a man walks through the field, his feet and legs will be quite covered over with a coating of red.

If the clouds break, after rain has ceased, and the sun comes out, then the blight is driven away. If a breeze blows from east at the time, it is intensified, but if the wind shifts round to west, it is blown off on the ground. The chief cause is assigned to the pressure of lowering clouds. If they are disturbed by the sun breaking out, or by a breeze removing the sultriness in the air; then there is hope of the blight disappearing in such cases, all that will remain will be mere discoloration. If, however, the sultry state of the atmosphere continue for three or four days continuously, then the disease is looked upon as certain to affect the whole crop. If timely rain, or west-wind intervenes, *within the three first days* of its first appearance, then it is washed or blown off, and no real harm is done, for the disease has had time only to get on the leaf, and not to spread to the ear of wheat in the leaf. The wheat leaf will gather its strength and greenness as it grows, and all trace of the discoloration even, will in such cases disappear.

The actual loss sustained by the crop is not known till the wheat ripens. The ear is found to have no grains, and where most of the blades turn out grainless, they turn yellow, and show what loss has been done about one month and a half after, *i. e.*, in the first fifteen days of April.

* Agriculture of the Réchna Doab.

Tela.—Is a dark colored powder, saltish to the taste, which lies between the outer and inner coating of sugar-cane and stops its growth, the only remedy for it is to wash it off with water. In wheat it causes the plant to turn black. (The "smut" on wheat, &c., is called *kali atta;* it is a fungoid growth).

Hada.—The drying up of leaves, and their becoming yellow in Sáwun and Bhadoñ, without any apparent cause.

Nisarna.—This is not a disease, but it is esteemed very bad for sugar-cane to blossom (nisarna), and such canes as blossom, being evil-omened, are taken up, and given to whomsoever will have them.

Pála.—Frost, when the north wind blows piercingly, it and the cold discolor the cane, the taste of which becomes saltish, and the produce is inferior; the cane has also a disagreeable smell, and the top dries up.

Kuchra.—In Jeth and Har, when the young cane is about 20 inches high, this insect eats the heart, and does very great injury to the crop, destroying as much as half perhaps.

Kungeearee.—These are barren branches, growing out of the cane, which do not give juice, neither will cattle eat them; if kungeearee prevail much in a crop, it injures it to the extent of one-twentieth.

Keeree.—An insect so called which eats the germ of young plants, particularly of sugar-cane. In Jeth and Baisákh, sometimes the crop is destroyed by it; rain or water is the best remedy; sometimes the "madár" plant (*Calotropis Hamiltonii*) is cut, and laid in the water which is to irrigate the field; the bitterness thus given destroys the keeree.

Soka.—Is occasioned by want of water, the cane dries inside, becomes hollow, and throws out great quantities of "chocc," or outer leaf.

Phirtee.—In Jeth and Har, young cotton plants, in maira soil, are liable to be injured by sand storms, which wound them, and they dry up. The remedy for this is to water the crop, by which means the sand holds together. Phirtee also injures sugar-cane.

Toka.—Is a moth, which injures young shoots by nipping them off, as if with a pair of scissors.

Dhimak, or *white ants.*—If rains do not fall in Sawun and Bhadoñ, white ants do great damage: rain kills them.

Trel or *dew.*—If heavy dews fall in Assuh and Kartak, the jowar crop is much injured, the grain cracks and becomes dark and almost friable.

Bhutoth.—This disease arises from the east wind blowing, which causes moth, mash and múng to shrivel up, and the pods do not fill.

Lishk, or *Lightning.*—Should it lighten much when gram is about to form its flowers, it injures them, and the pods do not fill well, and an insect is also produced thereby.

Tupkee.—When the rains are very heavy, the stalks of Indian-corn shoot up, and spindle, and yield no grain.

Another drawback to good crops, particularly in districts below the hills, such as Gujrát, Sealkot, and Gurdáspúr, is the frequency of hail-storms, which are prevalent in the months Phaggan and Chet, sometimes they come in October. At the former season they always cause much injury to wheat when it begins to ripen. In Tila in the Jhilam district, the "jogis" are propitiated to presents, to come and forwarn the people of storms. They plunge into a field with a drawn sword, or a knife is stuck into a mound with offerings placed round it; goats are often sacrificed, and people are stupid enough to pay for this deception. Lightning does damage to such crops as gram, masúr, flax, and til, which are called "phoilsah," or lishk-már, lightning-struck, in consequence. The flowers fall off and the seed is lost.

Crops are preserved from birds by scare-crows, or "daránas." A blackened earthpot stuck on a stick being a favorite method. In the case of tall crops, such as sugar-cane, &c., light platforms, called "manas" are erected, on which a person is stationed day and night to frighten birds, by shouting and discharging clay pellets, &c., &c.

Notwithstanding that the Punjab is a great grain producing country, some grain is imported from Malwa and the fertile districts, in its neighbourhood, the mart for whose produce is the city of Jhánsi, whence the grain is exported northwards. The internal traffic in grain is considerable, from the fertile districts. Large quantities of grain comes down the Sutlej to Fírozpúr. Rice is largely exported from Kangra to other districts. Hushyarpúr and the Jálandhar district supply much grain also to other districts. Sugar is exported largely from parts of the Punjab, both in a finished state and as "goor," or molasses. Latterly there has arisen a large export trade of wheat and sugar, cotton and oil seeds, towards England, *viá* Múltán and Bombay.

I. CEREALS.

WHEAT.

Botanical name—*Triticum vulgare,* Wild.

Native names—Kanak, Gehúṅ, Gandam, (Persian).

Wheat of all kinds is principally the growth of the rabí (spring) harvest. The number of varieties is not in reality very great, though considerable difference of nomenclature exists.

Some of the specimens exhibited are very fine—large white clear grains—but on the whole it must be admitted that much remains to be done for the agriculturist by an improved selection of seeds. Some of the varieties are of recent introduction, such as the Gilgit wheat, from the territory of that name, north-east of Peshawur. The two principal kinds of wheat are the "lál," or reddish-brown wheat, and "safed," or white wheat. The latter is the most esteemed, and has several varieties—the former is cheaper, and certainly of not so pleasing an appearance, but as the jury on this class remarked, does not appear to be in any way inferior in nutritious properties to the white sorts; on this account the use of this wheat is ordered in all jails in the Punjab.

Wheat is sown in the months of Kartak, and first half of Maghar for the rabí harvest, and is cut in Baisákh (April). When cut it is winnowed by men of the "chúra" caste, who receive as wages about 11 seers per máuí (6½ maunds), and get certain gleanings that fall beyond the heaps. The straw when broken up is called "bhúsa" or "túrí," in Punjabí, and is used for feeding cattle, and for various other purposes. The agricultural population do not generally eat the corn they grow, but reserve it for sale; they use barley, pulses, and other less valuable crops. Wheat is often sown mixed with barley; this is called "goji" in the Punjab, and "trikala," in Cis-Sutlej States, or with gram (*Cicer arietinum*) and then called "bhera;" or the red and white varieties, are sown together under the name of "jogyáṅ."

The principal kinds of wheat are exhibited as follows:—

I. RED WHEAT.

762.—[ ]. "Lál kanak," red wheat. DELHI MUNICIPAL COMMITTEE.

Red wheat is exhibited also from Ambálah (2652), Amritsar (2934), Lahore (3085). Value, 30 seers per rupee.

II. WHITE WHEAT.

Some of the samples are very fine. But there is every shade of difference conceivable; there is magnificent wheat from Yásín beyond Kashmír; very good wheat from parts of the Rawalpindi district, and also from Dera Ghází Khán. The principal varieties are the—

1. "Vadának," or "pamman," which is very like the dágar wheat of some districts.

2. The "ghoni" wheat, which has grains without skin or husk.

3. The Gilgit wheat (introduced), also callen paighambri and Múltání, small and very round grains.

4. The "daúd khání." There is also a variety called "kathya" in Sirsa.

The principal difference observable in wheats, is that some are bearded and some are awnless. Of the bearded wheat there are too sorts, one with a dark colored beard, the other with a light yellow beard. The principal varieties of grain are in appearance distinguished by their (1), opaque whitish color, and the absence of skin or husk, like the "ghoni" and "safed kanak" generally; (2), by their being almost round, like pearl barley, such is the Paighambri wheat; * (3), by their being besides large in size, of great translucency and clearness; daúd khání, &c. The wheats of the Hill states are generally small and inferior in color. The territories exhibiting them are, however, very nearly on the limits where wheat ceases to grow, so the inferiority is not to be wondered at. 13,000 appears to be the ordinary limit of wheat,

* The varieties shown as Gilgit and Múltání are apparently the same.

though it has been observed up to 15,000 feet in the Himálaya.

763. [2534], Ordinary white wheat, "safed kanak." Delhi.

The following districts also sent samples:—

Gurgaon (2571).
Karnál (2586).
Rohtak (2605).
Ambálah (2651).
Ludhiana (2685).
Jálandhar (2822).
Hushyarpúr (three varieties, 2893-5), (one being a mixture of red and white wheat sown together, which is called jogyáṅ).
Amritsar (2930).
Gújranwalla (ordinary white), (3164).
Jhilam (2nd class), (3235).
Gúrdáspur (3059).
Gugaira, four varieties (3723-6).
Muzaffargurh (3333): value 26 seers per rupee.
Dera Ismail Khán, two varieties, (3356-7).
Dera Ghází Khán (3382).
Bunnoo, (3423).
Peshawur (3440).
Hazara (3458).
Kapúrthála (3465).
Faridkot.
Jhínd (3761).
Nábha (3773).

The above are sent as "white wheat," without specification as to the variety to which locallity they were assigned. The following varieties of fine wheat were exhibited as specialities—viz.,

764.—[2640-44]. Series of wheats, grown at Fazilka and Sirsa. Mr. Oliver, Deputy Commissioner of Sirsa.

(*a*). "Pamman" wheat (otherwise called vadának): selling price, 30 seers per rupee.

(*b*). "Ghoni" wheat (small opaque white grain): the same price.

(*c*). "Dáúd kháni," large and very white grain. Introduced from the N. W. Provinces, and grown chiefly on the banks of the Sutlej, on alluvial and irrigated lands. This is much used by sweetmeat makers on account of its being so white. It sells where grown, at about 31 to 32 seers per rupee, always cheaper than pamman, being considered inferior.*

(*d*). "Kathya wheat:" value, 30 to 31 seers per rupee.

(*e*). "Janglí wheat," an inferior grain, almost like a wilding, hence its name: value, 32 seers per rupee.

765.—[ ]. Series of wheats from the Simla Hill states.

The Simla district exhibits a number of specimens, most of them poor wheats; No. 2697 from Bhají; Kothar (2756); Mahlog (2758); Dhámí (two varieties), (2773-74) Kanyár (2779); Balsain (2794); Baghat (2809); and Tiroch (2810).

766.—[ ]. Series of wheats from the Hill districts around Kangra. Local Committee.

The fields among the hills below Kangra produce about 3 maunds per begah, or nearly 5¼ maunds per acre.

"Wheat and barley are universal everywhere as the spring crop. Of wheat there are several kinds, the bearded and the beardless, the full white, and the flinty, red variety. Barley is uniform. Wheat grows most luxuriantly in the talooquas of Morí, Rajgírí and Nadaun, the soil of the tertiary hills seems the most congenial to it. The produce on the granitic soil of the upper valley, is always poor and thin. Barley flourishes in Harípúr, and all along the base of the snowy range. The ripening of harvest takes place later than in the plains, and varies according to the varying elevation. The crops in the outer ranges will be yellow, and ready for the sickle, while the fields about Kangra are quite green, and the lower portion of the valley will be cut and carried a month before the grain is matured in the Palam valley. From the beginning of April till the end of May is a succession of harvest times, and in the remote talooqua of Bhúngawal, the barley (for wheat is there unknown), does not ripen till July.†

767.—[2873]. Wheat from Lahaul. "Gro" *(pronounced dro, Thibetan)*. Rev. H. A. Jaeschke.

This wheat is very remarkable from its being produced in such a locality. It is said to be far superior to the wheat of Kúlú, it is not greatly cultivated however, as it requires warm and protected localities and much irrigation. (For an account of Lahaul crops, *see* under "Barley.") Samples from Lahaul were also sent by the Kangra Committee.

768.—[2877]. Wheat from Spiti.

Dr. Royle mentions that he has not seen wheat higher than 8,000 feet, but Gerard speaks of wheat at 10,000, and Captain Webb of wheat at 12,000,

* Local Committee, Sirsa.

† Barnes' Settlement Report.

on the Southern slope of the Himálaya. The extreme limit is given at 13,000 to 15,000 feet.*

769.—[2884]. Varieties of wheat called "káh" or "kán," and "tár," from Spiti.

The culturable territory of Spiti is divided into five kotees (divisions). The whole of them together produce 20,667 lakhs of grain (1 lakh = 12 pucka seers) or about 6,200 maunds.

The value is from 2½ to 3 lakhs of barley, and 2 lakhs of wheat per rupee. The people exchange grain as much as they can spare with Bishahr for iron, Thibet salt, and tobacco.

770.—[2912, 2950, 3304]. Series of wheats from Amritsar. LOCAL COMMITTEE.

(*a*). "Dáúd khání."

(*b*). "Múltání," also called "Gilgit" and "rai munír," small round grains.

(*c*). "Bherra," wheat and gram mixed.

771.—[ ]. Large grained "vadának;" wheat grown in villages Adálatgarh, Syjoke and Sealkot. LOCAL COMMITTEE.

Value, 35 seers per rupee.

772.—[ ]. Series of the wheats of the Lahore bazar. FAKIR SHAMS-UDDIN.

(*a*). (3083) Vadának wheat: value, 28 seers per rupee.

(*b*). (3083) "Dáúd khani," yields very white flour: value, 27 seers per rupee.

(*c*). (3086) "Kabr" wheat, not very common, and not of superior quality.

(*d*). (3087) Ghoni wheat: 27 seers 8 chittaks per rupee; sold as "paighambri" or "nikka" wheat.

773.—[3089]. Gilgit, called also paighambri wheat, grown at village Sánda, near Lahore. CHAUDRI IMAM BAKSH.

774.—Gujranwalla wheats.

(*a*). (3164) Vadának wheat (large grain).

(*b*). (3167) Fine wheat, perhaps dáúd khání.

(*c*). (3168) Gilgit wheat, small, clear round grains.

775.—[3192]. Fine vadának wheat from Pindi Gheb. RAWALPINDI LOCAL COMMITTEE.

COLONEL TREMENHEERE noted in his report on Agriculture to the Agri-Horticultural Society several years ago, that the finest wheat he had seen was grown in the valley of Barhán, near the village of Hassan Abdál in this district, the soil being calcareous and yielding per acre about 14 maunds.

There is a good sample of wheat like this from Gujrát (No. 3206), and Jhilam (3234), and Shahpur (called locally Dágar), from Naushera (3250), and from Dera Gházi Khán (3383). Gugaira, among its four varieties (3273-76) exhibits "Gilgit wheat."

776.—[3524-28]. Four varieties of wheat, the produce of Srínagar, Kashmír. H. H. THE MAHARAJAH.

The 1st kind sells for 36 seers per rupee, and is the produce of the spring harvest.

The 2nd grown in the autumn harvest, and sells at 20 seers. The other two are valued at 29 seers.

777.—[3528]. Wheat from Yásin. H. H. THE MAHARAJAH OF KASHMIR.

This is a peculiarly fine and large grained wheat.

778.—[3529]. Gúji (wheat and barley mixed).

Wheat is very little cultivated in Kashmír, the staple crop is rice, what little wheat there is, is almost entirely produced at the spring harvest; but one sample (3524) is marked as being autumn produce.

BARLEY.

Botanical names—*Hordeum hexastichon*, *Hordeum cœleste* (the beardless variety). Native names—Jau, (DR. CLEGHORN gives Ujou (Ajau) for *H. cœleste* in the upper Sutlej valley).

Barley is cultivated much in the same way as wheat, but is ready for cutting somewhat sooner, it grows much on sailabá and baráni lands; it is much less esteemed than wheat, and sells much cheaper, though it produces much more, and requires worse lands and less watering than wheat. The varieties are "jau desi," (common country barley), and "jau paighambri." "Ghoní" jau is barley that has scarcely any husk at all but only a fine skin. In the Hills barley succeeds better than wheat, and is much cultivated: its upper limit is 15,000 feet.

There is a black or rather dark purple barley, and a clear translucent barley of

* Notes on the Vegetation of the Sutlej Valley, by DR. CLEGHORN, p. 14; Journal of the Agri-Hort. Society of India, Vol. xiii, p. 4.

superior quality, both called *paighambri*, I believe that the term *paighambri* is applied as an equivalent for "superfine" or "uncommon." I have heard the "Gilgit wheat" called "paighambri: "*paighambri* jau literally means the "Prophet's barley."

779.—[ ]. The exhibited samples of common barley, or "jau desi," were as follows:—

Delhi (2536).
Gurgaon (2572).
Kurnál (2587).
Rohtak (8607).
Sirsa (6633): value, 1 maund 10 seers per rupee.
Ambálah (2653).
Ludhiana (2687).
Jálandhar (2823). In the Jálandhar district, barley is usually sown with wheat; if sown on unirrigated land the yield is 5 maunds an acre, if irrigated about 11 maunds. It is cultivated at a cost of Rs. 2¼ per acre.
Hushyarpúr (2900).
Rawalpindi (Pindi Gheb, 3191).
Gujrát (3207).
Jhilam (3236).
Shahpúr (3251).
Muzaffargarh (3334): value, 1 maund 5 seers per rupee.
Jhang (Maghyána pergunah), (3351). This latter was the only exhibited sample of any crop produced at Jhang, though there are samples of wheat from Jhang, in the Lahore Museum.
Dera Ismaíl Khán (3363).
Dera Ghází Khán (3385).
Bunnoo (3430).
Peshawur (3431): value, 1 maund 12 seers per rupee.
Kapúrthalla (3466).
Nábha (6774).

The finer kinds of barley, including the produce of the Hill districts, exhibited as specialities, were as follows:—

780.—[2633]. Black (purple) barley, recently introduced from the provinces. MR. OLIVER, Deputy Commissioner of Sirsa.

West of the Sutlej it is grown on lands inundated by the Ghágar river, but few acres have as yet been sown, but the Zamindars intend extending it.

781.—[ ]. Barley from the Simla States. The series consists of samples from Bhaji (2697); Kothar (2747); Mahlog (2759); Balsan (2795); Tiroch (2811); Bishahr (fine quality) 2815; the Deputy Post Master of Kotgarh exhibited "imperial barley" (2817).

782.—[2837]. Barley, the produce of Kangra and Kúlú.

783.—[ ]. Barleys from Lahaul. the REV. MR. JAESCHKE.

784.—[ ]. Barley of the sort called "sermo."

Short but rich ears with short awns and six rows of grain, cultivated in Ládah and Lahaul, not in Kúlú.

(2871) Large barley. "Che-nas" (*nas, pronounced né*).

(2872), Early barley. "Gyog-nas," (Tibetan) and "Yangma," in Ladákh, and "Thangzad" in Bunan dialect.*

It is also called "drug chunas," barley of sixty days, because it is said to ripen in two months. This is not grown in Kúlú but in Ladákh; and Zangskár barley sells at 20 seers per rupee.

Lahaul is divided from Kúlú by a range of snowy mountains. It comprises the upper course of the two streams Chandra and Bhága, which uniting under the common name of Chandrabhága, form one of the principal rivers (the Chenáb) of the Punjab. The people belong to a different type of the human race. Their features are essentially Tartar. They speak a language not intelligible to the natives of the neighbouring talooqua of Kúlú. The country is rugged and inhospitable. For six months snow covers the ground. The inhabitants descend to the more genial temperature of Kúlú, and return with the commencement of summer. The soil yields only one crop a year, and the grains produced are buckwheat and barley peculiar to the country. Spiti is a region almost, similar, except perhaps the cold is still more severe and the people less civilized even than in Lahaul. It is surrounded on all sides by lofty mountains inaccessible for half the year, and the mean elevation of the valley (along the river Spiti) is not less than 10,000 feet above the level of the sea. The people belong to a kindred race with those of Lahaul. The language is almost identical, but the customs and religious institutions are not

* The Bunan is a dialect of Tibarskad, spoken in part of Lahaul (*see* Cunningham's Ladákh, p. 397).

analogous. Here also the resources of the land are locked up for more than six months, in the rigours of winter. The inhabitants are obliged to repair during this inclement season, to the lower and more genial latitudes in the valley of the Sutlej.

The produce of the land in Lahaul and Spiti does not suffice for the wants of the population. The people of Lahaul import grain from Kúlú, and the valley of the Sutlej supplies the additional demands in Spiti. The crops in both talooquas are the same. The barley of Spiti is hexagonal or six-sided, and the grain large and succulent.*

785.—[2880-81]. Series of barleys from the province of Spiti, comprising barley of 1st and 2nd quality. KANGRA LOCAL COMMITTEE.

(2882) Barley, locally called "sowa."
(2883) Ditto, of the sort called "sarnoń."
(2884) Ditto, of the sort called "zezi."

Lahore. **786.**—[2961]. "Ghoni barley." AMRITSAR LOCAL COMMITTEE.

787.—[3089]. Jau Arábistán. CHAUDRI IMAM BAKSH of Sanda, near Lahore.

This is a very good barley grown at Sanda, near Lahore, from seed that was obtained from the countries bordering on the Persian Gulf.

788.—[3090]. Paighambri barley. Lahore.

A transparent barley known by its waxen appearance.

Gujranwalla. **789.**—[3168]. Paighambri barley.

Gugaira. **790.**—[3279]. White paighambri barley.

791.—[3280]. Black do., do.

Grows in Manserah and Harappa, producing about 12 maunds per acre.

Dera Ghazi Khan. **792.**—[3386]. Black paighambri barley.

Hazara. **793.**—[3451]. Barley.

A fine grain, having a wax-like appearance and a greenish color.

* BARNES' Settlement Report of the Kangra district.

Kashmir. **794.**—[3492]. "Karim," or paighambri jau, from Ladákh. H. H. THE MAHARAJAH OF KASHMIR.

Value, 29 seers per rupee.

795.—[3493]. 2nd quality barley, from Srínagar.

Value, 1 maund 8 seers per rupee.

796.—[3494]. 3rd quality.

Value, 2 maunds per rupee.

OATS.

Botanical name—(*Avena sativa*, L.). Native name—Javi.

These are only exhibited from two districts.

797.—[2654]. Oats, from Ambálah.

798.—[2502]. Oats, grown for Government cattle farm in Hissar.

MAIZE.

Botanical name—(*Zea mays*, L.) Native names—Makai, Challya (in Kangra and Kúlú) Jawár kalán (Persian) Kúkrí.

DR. FORBES' analysis of maize supplied from Bombay is—

Moisture, ...	12·90
Nitrogeneous matter, ...	9·23
Starchy matter, ...	74·63
Oily matter,...	1·59
Ash mineral constituent, ...	1·86
	100·00

The young stalks are used as fodder, the parched grain is called "chabina," and eaten; it ripens in the month of Assuh and Kátak, is cut and stacked out about 10 days in the field, and then the cobs are taken off, and beaten to separate the grain.

The varieties of this grain exhibit great difference in size and color, the maize of the plains is generally whitish and very pale yellow, or else deep red; the large grained orange-colored maize is generally grown in or near the hills, but is exhibited of excellent quality for Gujrát and other places.

799.—[ ]. Indian corn, mostly of the pale yellow sort, and of ordinary quality, is exhibited from Delhi (2538); Gurgaon (Noh-Tahsíl), (2564); Rohtak (2609); Ambálah (2669); Ludhiana (2688); Jálandhar (2826); (orange colored "pahári"); Hush-

yarpúr (2902); Gujranwalla (3171); Jihlam (3238); Gugaira (3284); Dera Ismail Khán (3371); Dera Ghází Khán (3394); Bunnoo (3927); Peshawur (3442); Kapurthálla (3471); Kashmír (3493).

Major Clarke's account of the cost of cultivating 2 acres with makai, kharif crop, is as follows :—

On 2 acres of maize or makai (produce first rate):—

	R.	A.	P.
Crop, 40 maunds, ...	26	10	0
Cost.			
Government dues, lumberdarí, &c., ...	7	4	9
Seed, ...	1	0	0
Hand hoeing, ...	4	0	0
Total Rs., ...	12	4	9

Payment in kind.

	MD.	SRS.
Watchman or bird-keeper, ...	3	20
Reapers, ...	1	8
Potter, carpenter, and lohar, each, ...	0	12
Mochi and dharwai, ditto,*	0	12
Chaukidár, barber and dhobí ...	0	6
Telí, fakir and mochí, ditto, ...	0	3
Khákrob, ...	1	8

	R.	A.	P.
Mds. 6, seers 29 = Rs.	5	7	0
Total expenses, Rs., ...	17	11	9
Gross profits, Rs., ...	8	14	3

Maize grows everywhere throughout the hills, and appears to flourish just as well in a temperate as in a tropical climate. At 7,000 feet or at 1,500 feet, it is the favorite crop of the people, and for six months of the year forms their common staple of food. Although superseded in the vallies by the rice, there is always a little plot of maize around the cottage of the peasantry, which is reserved for themselves, while the rice is disposed of to wealthier classes. To the uplands, maize is an admirably suited crop. It is very hardy, requires little rain, and is rapidly matured. In sixty days from the day of sowing, the cobs are fit to eat; but the grain will not keep. Weevils attack it in preference to any other grain, and it is a popular saying that the life of maize is only a year long. It sells at 30 seers per rupee.

The method of separating the grain is peculiar; the stiff ears of the maize bruise and draw blood from the feet of cattle, so the maize is threshed by men with bamboo sticks. For this purpose the cobs (chuchi) are gathered on the floor in a heap; a screen of blankets is set up round the floor to prevent loss of flying grain, and two or three persons are seated near, to replace in the heap cobs that are thrown out of the range of the blows.

The varieties of maize exhibited, were as follows :—

800.—[2703, 2736, 2748, 3761, 2776]. Orange colored maize from the Simla states, viz., from Bhaji, Bágal, Kothár, Mahlog and Dhámí.

801.—[2838]. Large maize, from Kangra and Kúlú.

802.—[2943, 2957, and 3016]. Yellow, white and red maize. Amritsar district. Local Committee.

803.—[3095]. Common maize, from Lahore. Fakir Shams-uddin.

(3094) Makai pahári (hills).

(2095) Makai Emanábádi (variety).

(2096) Makai Farakhábádi (variety).

These are varieties named after these cities, but grown in the Punjab.

804.—[3208]. Orange colored maize. Gujrat Local Committee.

805.—[3209]. Red variety, by the same.

(Makai or maize is not exhibited from any of the dry sandy districts, such as Múltán, Jhang, Gugaira, and Muzaffargarh.)

806.—[3493]. Maize, from Srínagar. H. H. The Maharajah of Kashmir.

807.—[3531-32]. Maize from the Jammú territory, by the same.

RICE—PADDY.

Botanical name—(*Oryza sativa*, L.) Na-

* The village weigher: he weighs out the produce when required for payment in kind or other purpose.

tive names—Dhán or Shálí; and when husked, Cháñwal, and Brinj (Persian); 'Arz (Arabic); boiled rice is called Bhát or Khushká; when bruised, Churwá; when boiled with milk, Khír or Firní. The names for the different varieties of rice occur in the sequel.

The varieties are almost endless, but there can be no doubt that a large number are in fact synonyms.

Almost every district where there are low lands, which are inundated either by natural or artificial means produces some rice; heavy dákar soil suits it. It is one of those crops that requires raising first in a nursery, after which the seedlings are planted out.

The district of Gugaira produces a considerable amount of rice by artificial irrigation, and profit is derived at the jail from husking the grain by prison labor. But the great rice producing places are Kangra and Peshawur, the former celebrated for its "básmati" rice, which is very largely imported into the plains, and the latter for its celebrated "bára" or scented rice, which is grown on the banks of the river Bára. The special products of each district will receive notice in their proper place in the sequel.

The following extract from Major Clarke's report, describes the cultivation of rice in the plain districts of the Punjab proper: an account of the hill cultivation is given separately.

"The first step towards the cultivation of rice is to raise seedling beds; the seed should be sown in Har, on a plot of ground well manured but not ploughed, *i. e.*, not two loose. A kanál or one-eighth of an acre takes about three seers of seed; the nursery must be watered every second or third day. In Sawun when the rains have been favorable, the seedlings are transplanted to the 'rohi' land, properly prepared by repeated ploughings and clod crushings; the latter process is not done with the ordinary sohága, but with a dentated one, a kind of harrow, which tears up and clears off obstructing roots and grass. The work of transplanting is sometimes done by the cultivators themselves, sometimes by hired laborers, who are paid by two and a half seers a maund of the produce when ripe. If the nursery is a good one, eight murlas of plants will suffice for an acre of plantation, the field must be continually flooded, and of course must depend greatly on the rains; when these fail, the crop is watered from a well or pond, or other reservoir; in the latter part of Kartik it ripens, and is reaped by the cultivator—if of small extent by hired laborers; if of large extent—reapers receive two pie or seven seers of grain, or one man's load of the straw and grain for every kanál reaped. When dry enough, the rice is separated from the straw by being trodden out by bullocks, and cattle are fed upon the straw. Where the crop is only on a patch of land, the grain is brushed out by a kind of threshing, or a sohága. Winnowing is paid for at two pie per maund of the paddy winnowed. Various items are claimed by village servants—as blacksmiths, potters, &c.—The average produce per acre, is twelve maunds.

The cost and produce of one acre of rice are as follows:—

	R.	A.	P.
Produce of first rate crop, maunds 26, ...	24	0	0
Cost.			
Govt. Revenue, 6 to 8 maunds, say,..	8	0	0
Lumberdár, patwárí, &c., ...	1	2	3
Seed, ...	0	8	0
Bird keeper, grain (wheat), ..	3	0	0
Reaper, 1 maund 8 seers (rice), ..	1	3	3
Sweeper, 18 seers, ...	0	7	0
Inferior village servants, including 15 seers for dharwai, 1 maund 26 seers = value, ...	1	10	0
Total expenses, Rs.	15	14	6
Gross profits, Rs.	8	1	6

808.—The following districts exhibited samples of the rice ordinarily grown in the district, as found in the bazars, without specifying any particular variety. Many of the samples were fair rices—of the qualities safeda and samoja.

Delhi (2541); Kapúrthalla (3472); Kurnál (rice and paddy), (2588-89); Hissar (Fattihábad), (2591); Rohtak (paddy), variety sáthi (2606). Only one or two varieties are grown in the canal villages. When husked, the grains have a reddish coat: produce 7 to 12 maunds per acre: value unhusked, from 32 seers to 1 maund 10 seers per rupee. Ludhiana (2686); Gujranwalla (3174); Gujrát (3205); produce 14 maunds per acre: price from Rs. 2 to 4 per maund. Jhilam (3237); Dera Ghází Khán (3887-88); Bunnoo (3429); Hazara (Khánpúr) (3460), Shahpúr (Bhera), husked and unhusked,

(3252-53), called Múnji: produce 14 and 15 maunds per acre, of which about half is husk.

The varieties of rice exhibited are as follows:—

809.—[2557]. Dhán (paddy), variety sukhdás, from Firozpúr Tahsil.
Gurgaon.

810.—[2581]. Dhán, variety sáthi (red skinned) from Rewari tahsil.

811.—[2526-32]. Seven varieties of rice from Sirsa. DEPUTY COMMISSIONER.
Sirsa.

(1) "Son-kharsa" or "kharcha:" sells from 14 to 16 seers per rupee: produce of the paddy from 14 to 15 maunds per begah.

(2) "Kharsú:" value, 27 seers per rupee.

(3) "Pesháwri." This was introduced by MR. OLIVER, it is considered very superior: at present there is not sufficient for the market, but seeds are kept for the ensuing season. It is grown on the banks of the Ghágar, and lands inundated by it. The produce per begah is about 12 maunds.

(4) "Básmati." This was introduced from the North Western Provinces: it sells from 8 to 9 seers per rupee. The produce per begah is from 13 to 14 maunds.

(5) "Sabzí:" value, 6 to 8 seers rupee.

(6) "Múnj:" value, 18 seers per rupee.

(7) "Súkhánand:" value, 10 seers per rupee.

812.—[2657-59]. Rice of various qualities, from Ambálah. LOCAL COMMITTEE.

1st.—Called "cháńwal, cháńbura:" value, Rs. 4 per maund.

2nd.—Called "Zeri:" Rs. 2-8 per maund.

3rd.—Called "Sathi" (red skinned): Rs. 1-7 per maund.

The 1st quality is grown especially at Manimájra.

813.—[ ]. Rice was exhibited from several of the Hill states of Simla.
Simla.

Bhaji, Mahlog, Bágal, &c., &c., the varieties are distinguished by peculiar names, viz.—

"Básmati:" value, 14 seers per rupee.

"Jhinjan:" second quality, value, 16 seers.

"Rehání:" third quality, value, 17 seers.

814.—[2833]. "Básmati" rice (Pálam valley). LOCAL COMMITTEE.
Kangra.

Value, 15 seers per rupee. The yield per begah is about 2¼ maunds of husked rice.

815.—[2855]. Specimens of rice in the ear, from the Kangra district. LOCAL COMMITTEE.

The varieties contained in the box are called—Madlya malti, Nakandi, Jinwa, Rangari, Gangá jumni, Kotheri, Nakanda, and Kamodh.

It is a common saying in the Kangra district, that there are 360 varieties of rice, and that the subdivisions of the Girth tribe—the usual cultivators of rice—are equally extensive.

The following extract from BARNES' Settlement Report, describes the method of rice cultivation in the Kangra valley:—

"The upper valleys of Kangra are the granaries of rice. Here are combined the abundance of water with high temperature and a peculiar soil, which makes rice so exclusive a product. The people recognize upwards of sixty varieties. The most esteemed kinds are 'begamí,' 'báńsmatí,' 'jhinwa,' 'nakanda,' 'kamodh,' 'rangari,' &c. Each of these sorts has a special locality.

"Thus Rihlú is famous for its begamí rice, and Pálam for its báńsmatí.

"These are the finest rices. In the more elevated parts of the valleys, a coarser kind is grown. The local names are 'kutherí,' 'kolhena,' &c.

"The irrigated parts of Harípúr and Núrpúr also yield good rice, but not equal to the produce of the upper valleys; and generally throughout the district wherever the land is fertile and level, rice is cultivated as a rain crop. The varieties sown on the dry lands are coarse and more hardy. The local names are 'rora,' 'kalúna,' 'dhakar,' &c.

"On lands which can command irrigation, the rice is not sown till the beginning of June. In districts dependent upon rain, the seed is thrown into the ground as early as April, and the later the season of sowing the less chance of the crop reaching maturity. The harvest time is during the month of October. There are three modes of culture. Two by sowing the seed, and one by transplanting. The first and simplest is called 'butur.' The seed is sown broadcast in its natural state. On unirrigated lands this is the universal method. The second consists of steeping the seed and forcing it under warm grass to germinate. The seed with the tender shoots is then thrown into the soil, which has previously been flooded to receive it. This method prevails wherever water is abundant, and is called 'much' or 'loonga.' The third is a system of transplanting styled ''aor.' The young plant about a month old is taken and placed out, at stated intervals, in a well-flooded field. This practice involves a good deal of trouble, and is

seldom followed, except in heavy swampy ground where the plough cannot work. The yield of transplanted rice is always greater than under either of the other methods.

"In the month of July the people have a curious way of killing the weeds, which I have never observed in any other part of the country. The crop, weeds and all, is deliberately ploughed up and turned over. Immediately after the operation the whole appears utterly destroyed. But the weeds alone suffer. They are effectually extirpated by this radical process, and the rice springs up again more luxuriantly than ever. This practice is called 'holdna,' the crop is worthless which does not undergo it. Rice is always sown by itself and never mixed.

"The rice is separated from the husk by the use of the hand pestle and mortar; women are usually employed upon this labor, and when working for hire receive one-fourth of the clean rice as their wages. This article is extensively exported, and in the cold season the roads are thronged with droves of oxen, mules, &c., brought up from the Punjab by traders.

"Rice has a very extensive range. In the district of Kangra proper, I have seen it as high as 5,000 feet above the sea. In Kúlú it grows as high as 7,000 feet in the valley of the Beás."

816.—[2886-2892]. Varieties of rice from Kúlú. LOCAL COMMITTEE.

The series consists of the following—Jhinjan, sáthí múshki, and minálu.

817.—[ ]. Jhinjan rice from Suket. KANGRA COMMITTEE.

Value, 18 seers per rupee.

818.—[2896-2900]. Specimens of rice and paddy of varieties Básmati and munji, from Hushyárpúr.

Hushyarpur.

819.—[2933-41, 2979-3008, and 3026-3030]. Series of rices to be had at Amritsar. LOCAL COMMITTEE.

Amritsar.

The list contains a very large number of varieties, many of which are imported. But the Amritsar district produces a considerable quantity of rice, and one kind is the "múskhan,"—musk-scented rice, which is supposed after having been kept three years to give out a fragrant odour.

There is a specimen of the paddy and the rice of each variety. The sorts are—

Básmati; Safed básmati; Chhona; Chhona safed; munjí.

Sathí, 1st quality (red skinned); so called because it ripens exactly in 60 days (sath).

Sathí, 2nd quality, do.

Sharbati (yellow husked).

Ratua (very similar).

Ratua, 2nd quality.

Dúhni.

Changoa.

Múshkan.

Karhú or Karhsú (inferior).

Bára (imported from Peshawur).

Urár. (The word "urár" implies "this side of the river," hence the term may merely distinguish the the place of production of the rice without indicating a variety.)

Begami.

Chinwalál.

Són.

Phat Indar.

Phat Kanguwán.

820.—[3064]. Rice from village Chakramdás, Daska.

Sealkot.

Price, 12 seers per rupee.

821.—[3065]. Rice, básmati, from Siráñwali village, and Bíkapúr of Pasrúr.

10 seers per rupee.

822.—[3060]. Rice from Chakramdás and Bíkapúr.

16 seers per rupee.

Sealkot is celebrated for production of rice, but only in a very few localities in the district. At Siráñwali village in the jaghír of Sirdár Mangal Singh, a small quantity of rice is grown, hardly inferior to the famous básmati of Kangra.

The young seedlings after being removed from the bed in which they were sown, are not immediately transplanted as other rices are, but are put into milk and allowed to soak for a fixed period, and then planted out; it is said that this process imparts the whiteness and delicacy for which the rice is noted.

823.—[3074-78 and 3097-102]. Series of rices and paddies found in the Lahore bazar.

Básmati, 1st class; Safeda, 2nd class; Samoja, 3rd class; Chambua (Changúa); Sónpat; Magoi; Begami; Chhóna gol; Sathi; Ratua; Múnji.

824.—[3079-81]. Rices grown in villages along the banks of the Raví. DR. FARQUHAR.

Viz., from Sidhoteri, Khosi, &c.

825.—[3281-85]. Four varieties of rice from Syadwalla, &c. GUGAIRA LOCAL COMMITTEE.

Múskan; Sonpattar; Safeda; Chanwa lál (probably equal to sathi).

Rice is entirely confined to two localities, viz., the Degh river and Khanawa canal. The Zemindars not only believe that this grain must be raised on the banks of a canal, which supplies constant and abundant irrigation, but fancy that the water obtained from wells is not sufficiently fertilizing, or "fat" as they express it for this purpose. The quality of the crop, however, on the Kanawa canal is very inferior, a circumstance more attributable in all probability to the negligence and unskilfulness of the cultivators, than to any defect of the soil, or inferior quality of the water.

Some attempts were made to improve the rice by distributing a small quantity of superior seed obtained from Peshawur, but the produce though good for the first year, is said to have speedily degenerated. The rice produced on the Degh nullah is of good quality, and a peculiar description of it, called "múshkun," from a pleasant perfume which it is supposed by the natives to possess,* (but which I confess, I have never been able to discover myself,) is well known and appreciated in this part of the Punjab.

The local consumption of this grain is very limited, but considerable quantities are exported to Lahore. About 30,000 acres are under rice cultivation in this district, and the produce may be estimated at about 4,00,000 maunds.†

826.—[3432-33]. Bára rice, husked and unhusked. PESHAWUR LOCAL COMMITTEE.

This is the principal exported variety, and is highly prized for its fragrance; it sells at a high rate, sometimes as much as a rupee per seer. The quantity produced is very limited, probably not more than 20 maunds in a year. It is exclusively grown on lands irrigated by the river Bára, in the Peshawur valley.

In the Sikh times the produce at harvest time was divided into three portions—the best was reserved as seed to perpetuate the stock; the 2nd best share was sent to Lahore for consumption of the court and nobles; the 3rd or worst share was left for the Zemindars to dispose of as they pleased.

The cultivation of the rice has very much fallen off from what it was in Sikh times, but then the Zemindars were encouraged by Government to produce, had a certainty of realizing a high price, and officers were appointed to superintend the cultivation, and thus there was an inducement, which does not now exist, to overcome the great difficulties of cultivation, and apply the constant care necessary for a successful crop. Ground to the extent of 290 jaríbs was cultivated in Sikh time, at present only 60 jaríbs are sown: it is now produced only at villages Shekhan, Mosteizai, and Garhi-Malhi-khail in the Mohmand Tappah. The yield per jaríb is from 5 to 6 maunds of the best bára rice.

Besides this rice there are several varieties grown on land irrigated by the Kábul, Swat and Bára rivers, in the valley. They are—

"Doába" (so called from the perganah Doába, where it grows): sells at 3 seers per rupee.
"Shogha," „ 10 seers per rupee.
"Zafráni," „ 10 seers do.
"Kunér," „ 8 seers do.; grown at Kunér.
"Brinj luk," or coarse rice:* 14 seers per rupee.
"Jyotshi:" 10 seers do.

The shoga and zafráni rices produce from 10 to 12 maunds per jaríb, and "luk," from 13 to 14.

827.—[3506-3510]. Five varieties of rice. Kashmír. H. H. THE MAHARAJAH.

Rice is extensively cultivated in Kashmír, and is of excellent quality. It has as in Peshawur and Kangra the benefit of the irrigation of hill streams. Rice forms the principal food of the people, together with pulses to a certain extent. Wheat appears to be very seldom used.

The exhibited varieties were:—

"Básmati:" which sells at 36 seers per rupee (the paddy).

"Básmati," 2nd quality: 1 maund per rupee (the paddy).

"Sukhdás:" 1 maund of the paddy for 10 annas.

"Kan[illegible]"

"Shiriwál."

These are the produce of Jammú, and also Srínagar.

828.—[3768-69]. Two qualities of rice. H. H. THE RAJAH OF JHIND.

829.—[3775-76]. Two varieties of rice. "Shálí sathi," "shálí zin." H. H. THE RAJAH OF NABHA.

* The rice does not acquire fragrance on its first being gathered, but after having been kept three years it is supposed to attain it—a distinction is made in the market between "nava múskhan," "new grain" and the old, which has attained its fragrant property.—B. P.

† Gugaira Settlement Report—ELPHINSTONE.

* The term "luk" is also applied to coarse grass. In Bunnoo "kundar" has a similar signification.

II. MILLETS.

Millets are extensively used as food, they are principally cultivated for the kharíf harvest, and are ripe in the autumn.

GREAT MILLET—JAWAR.

830. —Botanical name, *Holcus sorghum, Sorghum vulgare;* also called Jawár Khúrd or Barík.

There are two varieties, one with a reddish grain and one white: in districts where makai (maize) is called "bara jawár," this plant is called "chota jawár" or "jawár bárik." When jawár is used for fodder and cut down while green it is called "chari." When sown for fodder it is much more thickly sown than when grown as a grain: in the former case 50 seers of seed are required to sow an acre; in the latter only 10; manure is given to this crop.

The cost and produce of four acres of jawár, may be estimated as follows :—

Produce.	R.	A.	P.	Cost.	R.	A.	P.
First class, 32 maunds,	21	5	0	Government revenue,..	5	5	0
				Lumberdar (headman's fees), ..	0	4	3
				Seed, 32 seers, ..	4	0	0
				Reaper, 4 maunds and 32 seers,..	3	3	0
				Sweeper, 3 mds. 20 seers,.. ..	2	5	0
				Hand-hoeing, ..	4	0	0
				Inferior village servants, 3 mds. 36 seers,.. ..	2	9	9
	21	5	0	Total expenses, Rs., ...	22	3	0

These results do not show a money profit, but if the cultivator has the seed and does the hoeing himself then the case is different. If grown for fodder the cost is much less, and jawár does not always need hoeing. In the tabular list of Lahore produce, before given, jawár is marked as not requiring to be hoed.

Most districts sent jawár, as—Delhi (2537); Gurgaon (2575); Hissar (2593); Sirsa (2635); Ambálah (2656); Ludhiana (2689); Simla (Mahlog) (2762); Jálandhar (2827); Lahore (3068); Gujranwalla (3172); Gujrát (3210); Jhilam (3239); Shahpúr (3258); Dera Ismail Khán (3309); Dera Ghází Khán (3390); Bunnoo (3428); Kapúrthalla (3471). Amritsar exhibited both red and white varieties of the millet, as also Gugaira (3285-86), and Muzaffargarh (3325).

IMPHI—JAWAR WILAYITI.

831.—Botanical name, *Sorghum saccharatum*—Chinese sugar-cane, "*sorgo sucré.*"

Only two samples of this grain are exhibited, Rohtak (2608), Kangra (2841).

In the Kangra district it is used as a valuable fodder for cattle, which indeed, notwithstanding the statement in the subjoined extract, appears to be its principal value, as it can be cut down, three or four times a year, and it sprouts again.

The Rohtak sample is probably only a variety of jawár, it forms when cut up a fodder for cattle called "karbi," and its grain is used as a porridge, and also made into cakes: it is extensively cultivated. This description answers better to jawár (*Holcus sorghum*).

The following extract was published by the Financial Commissioner in his Circulars, Nos. 105 and 112 of 1859.

"This plant is attracting much attention in France and the United States. As a forage plant, it is said to be unsurpassed. It readily hybridizes with its congeners and varieties, so it should not be sown near a similar plant. It can be cultivated wherever corn is.

"There are some 30 species of *sorghum*, but some only contain saccharine matter.

"The juice affords sugar, alcohol, and a liquor like cider.

"It is planted in drills about 3 or 4 feet apart, the stalks grow about 2 feet apart. It sends up new shoots after being cut, so that three crops per year proceed from one plant. In a tropical climate it becomes a perennial. It makes a fifth to a fourth of its bulk in good syrup.

"When the seed becomes quite ripe, the fodder is pulled and seed heads cut; the yield of fodder per acre is 1,100 to 1,300; the yield of seed 2536 bushels. On first trial 70 average canes gave 20 quarts of juice, 606 average canes passed once through the rollers gave 38 gallons 1 quart of juice, and a second time 2 gallons of juice. The 40 gallons 1 quart so obtained yielding 8 gallons thick syrup."

The cultivation of the plant was attempted in the Sealkot district; and in 1862, on the occasion of the distribution of flax prizes, some fine samples of imphí were brought in by several landowners: the cultivation was subsequently discouraged, as the crop was not found in practice to be very successful.

Mr. J. W. Macnabb, Deputy Commissioner, writes as follows:—

"The success of the Chinese sugar-cane sown in the Sealkot district was uncertain, owing to its having been treated as a sugar-cane crop, instead of a rain crop, like the jawár. Boodh Singh, Chowdrí of Mirza, in Sealkot, deserves encouragement, for the way in which he has introduced this staple. I saw some stalks at least 12 feet high, and he even brought me three cakes of raw sugar (goor) extracted from the same, which I find has a less value in the market than that taken from country sugar-cane. He seemed to doubt if the staple would pay."

KANGNI—ITALIAN MILLET.

832.—Botanical name, *Pennisetum Italicum.*

This millet is cultivated in both harvests. The grain is much used in the Punjab for feeding poultry, &c. It is very little used as food otherwise: when ripe the grain is shaken out into small pits smoothly "leped" or plastered with mud inside; sometimes it is trodden out by cattle: the straw serves occasionally as fodder. As a food it is nutritious, but is said to be heating and apt to produce diarrhœa. Specimens were sent from the following districts:—

(2548) Delhi.
(2583) Gurgaon.
(2611) Rohtak.
(2660) Ambálah.
(2705) Bhajjí—Simla district.
(2728) Kumhársen, do.
(2739) Bagal, do.
(2751) Kothar, do.
(2785) Sirmúr, do.
(2800) Balsan, do.
(2847) Kangra.

833.—[2904]. Husked kangni, called "cháñwal kangani (lit., rice of Kangani). Hushyarpur Local Committee.

These series of millets when husked and ready for use, are called cháñwal, with the distinctive name added. Specimens were sent from—

(2972) Amritsar.
(3107) Lahore.
(3183) Gujranwalla.
(3255) Shahpúr.
(3288) Gugaira.
Muzaffargarh, where it is called "gall."
(3368) Dera Ismail Khán.
(3391) Dera Gházi Khán.
(3443) Peshawur.
(3467) Kapúrthalla.
(3512) Kashmír.

CHINAN, OR ARZAN.

834.—Botanical name, *Panicum miliaceum,* Wild.

This crop is not so profitable to cultivate as some others. The cost of a ghumao of land is as follows:—

Produce.	M.	S.	C.	Cost.	M.	S.	C.
Chínáñ, one ghnmao,	5	..	..	Seed,	..	10	..
				Govt. revenue, ..	1	20	..
				Sweeper, ...	1	10	..
				Carpenter, ...	..	5	..
				Mochi, ...	..	5	..
				Dhurmsala, mirasi, chowkídar, Brahman, Mulla, each one seer,	..	5	0
				Potter, ...	..	4	..
				Dharwai (weighman), ...	..	5	..
				Total,	3	27	..
				Balance profit,	1	13	..
	5	..	..	Grand Total,	5	..	..

Its cultivation and mode of threshing, and properties as a grain are similar to the last.

Samples were exhibited from the following districts, there is little difference in the samples except that some are larger, more glossy and yellower than others. In the Muzaffargarh district, it is noticed as much consumed by the Musulman population; it sells at 1 maund 5 seers per rupee. Specimens were exhibited from

Gurgaon (2582); Ambálah (2661); Kumharseñ, Simla (2729); Balsan, do. (2799); Kangra (2846); Kúlú (2891); Hushyarpúr (2906); Lahore (3104); Gujranwalla (3184); Gujrát (3219); Gugaira (3289).

BARTI.

835.—Botanical name, *Panicum brizoide.* From Palwal. Deputy Commissioner, Gurgaon.

This is the only sample exhibited; the grain is quite uncommon in the Punjab.

SAWANK.

836.—Botanical name, *Oplismenum frumentaceum,* Rox. Synonyms—Samáñk, Karín (Kashmír).

This grain is less commonly cultivated than chínáṅ. There is also a wild species found *(Panicum colonum)*; it is very little used by the inhabitants of the Punjab proper, except by Hindús, who eat it on fast days—the "ekádashí," and 11th day of the moon's increase and decrease. Daráuṅ (buckwheat) and singhára or síl may be eaten also in those days, but not wheat or cereals.

Samples are sent from—

(2547) Delhi.

(2578) Gurgaon.

(2699) Hissar, where it is called a grass in the district list.

(2663) Ambálah, accompanied by a sample of the husked grain.

Bhaji, of Simla (2706); Bagal, do. (2737); Mahlog, do. (2765); Hushyarpúr (2909); Amritsar (2970-3009), had a sample of the husked grain; Lahore (3080-3082), both the whole grain and the ground grain or "rice;" Gujranwalla (3181); Shahpúr (3256); Gugaira (3290); Muzaffargarh (2337); Dera Ghází Khán (3402); Kashmír (3523).

BAJRA—SPIKED MILLET.

837.—Botanical name, *Penicillaria spicata*, Wild.; *Holcus spicatus*, L.)

Grown at both harvests, but principally at the kharíf: like the other millets it is said to be heating and to produce diarrhœa: it is a superior grain to the last and more often met with. The stalk is useless as fodder when dry, but cattle are sometimes fed on the young crops as it stands.

It is eaten most in the cold weather as flour, and made up into "roties," and occasionally with buttermilk: its grain is much consumed in the districts between the Jhilam and Indus, called generically "pahwar."

Samples are sent from:—

Delhi (2538); Gurgaon (2559); Hissar (2624); Rohtak (2610); Sirsa (2634), price 1 maund 10 seers per rupee; Ambálah (2655); Ludhiana (2685); Kangra (2840); Hushyarpúr (2907); Lahore (3105); Amritsar (2968); Gujranwalla (3173); Gujrát (3211); Jhilam (3240); Shahpúr (3257); Gugaira (3287); Muzaffargarh (3336); Dera Ismail Khán (3360); Dera Ghází Khán (3389); Peshawur (3443); Kashmír, Jammú, (3489); Simla, (2963); Mahlog. This grain seems to be uncommon in the hills; none of the other Simla States send specimens.

Barnes, writing of the Kangra districts, observes that he never saw it in the hills, and only on the southern part of Núrpúr, where the hill verges on the plains.

KODRA.

838.—Botanical name, *Paspalum scorbiculatum*, L.) Synonym—Kodoṅ.

This is not a very common grain, nor has it any qualities to recommend the extension of its cultivation. There is also a confusion of name between the millet and the one following. *Koda* is another name for *mandwa*, and hence a confusion is likely to result between *kodra and koda*. Some of the Simla samples called by the name, should be referred to *mandwa*. In the Bijnour district writes Dr. Stewart;* "Kodra is said to produce cholera and vomiting, and I find that some authors mention a similar phenomenon as occasionally occurring in all three presidencies. The natives generally hold that with the ordinary kodra and undistinguishable from it, grows a kind they call majna or majni, which produces the above effects, but it has been with greater probability suggested, that these depend on the use of the new grain under certain conditions. These results, however, cannot be common here, as a very intelligent old gentleman of the district informed me that he has never seen a case."

Kodra is exhibited as follows:—

Gurgaon (2576).

Bhaji of Simla (2704).

Mahlog, do. (2764).

Bágal, do. (6738).

Balsan, do. (2801).

Ambálah (2664), where only a very little is produced.

Kangra and Kúlú (2848).

Hushyarpúr (2905).

Amritsar (2971).

Gujrát (3222).

Kashmír, Srínagar (3522).

MANDWA.

839.—Botanical name, *Eleusyne coracana*, Gært.) Synonyms—Mandal, Marwa, Chalodra. Koda (in the hills).

This is principally a hill product, but is also cultivated in Sealkot and other districts. In Lahore however a sample is obtained with some difficulty; this grain is never attacked by insects, and will keep any length of time. The haulm or stalk, which is flat, is so exceedingly tough and strong, that the crop is gathered in by plucking off the heads, and leaving the stalk standing.

Samples are sent from Gurgaon (2558).

Kangra hills (2845). The produce in this district

* Food of the people of Bijnour.

exhibited 2¼ maunds per begah. The Local Committee remarks of this and other millets in the Kangra district, that they form an important part of the food of the people.

Ambálah (2662).
Bhaji, Simla (2707).
Kumharsen, do. (2727).
Bágal, do. (2738).
Kothar, do. (2750).
Hushyarpúr (2910).
Lahore (3106).

This grain is exhibited under the name chalodra, from Kashmír (3497); and Gujrát (3207).

In this class it may be proper to include several doubtful grains which are wild, and are used occasionally as food: in appearance they resemble millets. They are:—

840.—[2646]. "Samák," wild sawáṅk *(Panicum colonum)*, from Sirsa.

841.—[2649]. Phog. Sirsa.

842.—[2844]. "Tánk." Kangra and Kúlú.

843.—[3403]. "Koreah." Dera Ghází Khán.

Both these last are wild grains, probably species of *Panicum* (as *P. colonum*). Price, 25 seers per rupee.

III. PULSES.

This class of produce shows more variety than any of the foregoing; there are some common pulses, which are grown in almost all districts alike, but there are others which are peculiar to certain districts; the synonyms in this class are interesting, the collection on the whole in this department was full and satisfactory.

Most of the pulses are used when the seed is split, and forms what is called dál. There is *dál masúr, dál urad, dál mung, &c.*, implying split lentils, split urd, &c., &c. They are much eaten by the natives boiled, either alone or with rice, and cooked with oil or ghí, red pepper, &c., &c. Some kinds are eaten boiled while green, as "*tarkári,*" vegetables. Gram (*chola*) is eaten parched, or it is ground into a flour called *besan:* it forms also the principal food of horses and goats.

Másh, múng and channa (gram), are the pulses most in use, but some of them are said to produce flatulence and colic. *Churál* is said to be hard and indigestible. *Rawán, bákla lobya,* and *guwár* are less common, and are not grown at all in many districts.

MUNG.

844.—Botanical name, *Phaseolus mungo,* L.; *Phaseolus Max,* W.

A kharíf crop, entirely dependent on rain, is not suited to low-lying or inundated lands, but grows in bangar and bar edge lands. This is the "green gram," and there is also a black variety which is called *Ph. Max,* but the green is far the commonest in this province.

Múng was exhibited as follows:—

Delhi (2564); Gurgaon (2552); Rohtak (2613); Sirsa (2626), where it sells for 1 maund per rupee; Ambálah (2670); Ludhiana (2694); Simla States, Bhaji (2714); Kothi (2792); Kangra (2854); Amritsar (2952-53), with a specimen of the dál of múng; Lahore (3123-25), both the black and green varieties, with dál of the same; Gujranwalla (3176); Gujrát (3212); Jhilám (3244); Shahpúr (2260); Gugaira (3292); Muzaffargarh (3345); Dera Ismail Khán, (3362); Dera Ghází Khán (3425); Bunnoo (3398); Peshawur (3954); Kashmír (3434-35); Jammú territory.

SAFED MUNG.

845—Botanical name, *Phaseolus aureus.*

This grain is a mere variety; uncommon however.

MASH.

846.—Botanical name, *Phaseolus Roxburghii,* W. & A.; *Phaseolus radiatus,* Rox. Synonyms—Másh, Urd, Máṅh, (Karothi, Kashmir).

This is grown extensively on sailabí land as a kharíf crop. The stalk is excellent fodder, and the grain is said not to be attacked by insects. ROXBURGH remarks that it is the most esteemed of the *Leguminosæ* and bears the highest price. DR. ROYLE says that the root contains a narcotic principle. There are two varieties, black and green.

Specimens were sent from—Delhi (2542); Gurgaon, both varieties, (2559-60); Rohtak (2614); Ambálah (2671); Ludhiana (2693). The Simla Hill States as follows:—Bhaji (2713); Bhagal (2741).

Kothár (2753 A).
Mahlog (2767).
Dhámi (2775).
Júbal (2788).
Koti (2790).
Balsan (2803).
Jálandhar, Nawáshahr, (2828).
Kangra (2851).

Máh is the best of pulse crops in this district: it is often grown along with kúlth (*Dolichos uniflorus*, W). The produce of this crop is eaten and called "mah chapal;" the produce of máh per beegah is about 12 maunds.

Hushyurpúr (2917).

Amritsar, both varieties, with the dál of each kind (2945-49).

Lahore, a similar series (3117-20).

Gujranwalla (3177).

Gujrát (3214).

Jihlam (3243).

Bunnoo (3426).

Rawalpindí (3194).

Shahpúr, Khusháb (3259).

Gugaira (3291).

Muzaffargarh (3393). Value, 18 seers per rupee.

Dera Ismail Khán (3367).

Dera Ghází Khán (3405).

Peshawur (3452-53), both varieties.

Kashmír, both varieties, one of them marked "másh safed" (3538-40). Black másh is called in Kashmír "karothi."

Nábba (3783).

Jhínd (3771).

MOTH.

847.—Botanical name, *Phaseolus aconitifolius*, Jacq.

This is a kharíf pulse unsuited for growth on sailabí land, but well grown on any other. It is dependent on rain for its growth; and is reckoned inferior as a pulse to the foregoing species of *Phaseolus*. The leaves of the plant are deeply indented like those of the aconite, hence its botanic name of *Aconitifolius*.

Specimens were sent from :—

Delhi (2545); Gurgaon (2580); Hissar (2596); Rohtak (2615); Sirsa (2635), where it sells at 1 maund 5 seers per rupee; Ambálah (2673); Ludhiana (2692); Hushyarpúr (2916); Amritsar (2954-57); exhibits both "safed moth" and dál made of moth; Lahore (3120); Gujranwalla (3178); Gujrát, moth "safed" (32); Sirsa (3215-16); Jhilam (3245); Shahpúr (3262); Gugaira (3293); Muzaffargarh (3346); Dera Ismail Khán (3361); Dera Ghází Khán (3396); Peshawur (3545); Kashmír (3537); Jammú territory (3543).

848.—Jameson gives another *phaseolus* viz., *Ph. torosus*, under the name of "ghurúsh," in the Kangra valley.*

GUAR.

849.—Botanical name, *Cyamopsis psoraloides*, De C.; *Dolichos psoraloides*, Lam.; *Dolichos fabæformis*, Wild.

This is not a common pulse in the Punjab. It is distinguished by its pale grayish color.

It appears that guár is almost exclusively cultivated in those parts of the province that were formerly in the North Western Provinces; where it is also called guár múng. Gujrát is the only district in the Punjab proper which exhibits a sample: the pulse is stated by the Rohtak Local Committee to be made into dál, but to be used principally for cattle; it is boiled in a pan and then the grains are rubbed and worked about with the hand till a froth rises on the mass: a little mustard seed oil is then added; it is given to cattle to fatten them.

Samples appeared in the collections of Delhi (2546) Gurgaon, Rewari, (2548); Hissar; where it is called guár múng (2594); Rohtak (2616); Sirsa (2638); where it sells for 1 maund 15 seers per rupee; Gujrát (3216).

GRAM OR CHANNA, OR CHOLA.

850.—Botanical name, *Cicer arietinum*, L. Synonyms—Bengal gram, Chick pea—Chola—Nakhúd, (Per.), Humúz (Ar.)

The grain has a peculiar shape, being partly spherical, but with one side pulled out into a point. Pliny, in describing the variety, says it is in the shape of a ram's head, whence it is called now *C. arietinum*.

The plant is said to produce oxalic acid, and in some places cloths are spread out at night over a growing field of gram: the dew falls and becoming impregnated with the oxalic acid of the plant, is absorbed by the cloths; these are wrung out into a vessel, and the liquid drunk as a cooling beverage. This is not done however, as far as I am aware, in the Punjab. The natives often eat the grain parched under the name of chabína; I have seen it eaten in the same way in Egypt.

Gram is a rabí crop: after cutting in Baisakh it is left several days in the field to dry, and is eventually trodden out by cattle. The grain is remarkable for the small proportion of nitrogenous matter it contains, as compared with Lathyrus and other species.

This does not appear to be a pulse grain of the hills. None of the Simla States but Mahlog, Kothár and Sirmúr exhibit it, and kulthi (*Dolichos uniflorus*) seems to take its place in Kangra in which district it is not produced except at a few places.

The gram or chick pea is never grown in the Kangra perganah, and is scarce in Haripúr. Nadaun and and Núrpúr are its chief localities. There is a belief current in the hills, says Barnes, that there is some

* Agri. Hort Soc. Journal, Vol. viii., p. 185. (Correspondence and Selections).

affinity "in the grain field which attracts the lightning, and after a storm I have certainly observed whole tracts scorched and destroyed as if by fire."*

There are several varieties—(1), The ordinary gram, yellow with brown or reddish brown skin; (2), Kábuli or white gram, being of a pale stone color, sometimes with a coat of red as in the Muzaffargarh sample, and has the pointed prominence less developed; (3), Black, with husk quite black.

The ordinary grain was sent from Delhi (2545); Gurgaon (Jhassa), (2573); Karnál (2540); Hissar (2594), Rohtak (2612); Simla States—Kothar (2754), Mahlog (2766); Sirmúr (2787); Jálandhar (2824).

Kangra sends a sample which is remarkable as having been grown in Kúlú (2849); Hushyarpúr (2911); Sealkot (3067); Gujranwalla (3175); Rawalpindi, white variety (3193); Jihlam (3241); Shahpúr (3264); Gugaira (3295); Dera Ghází Khán (3393); Kapúrthalla (3478); Kashmír (Jammú), two varieties, (3354-55); Dera Ismail Khán, two varieties (3357-58).

Ambálah (2665-67), three varieties—the black, white, and ordinary.

Amritsar (2949-50-51, 3032, 3040-42), exhibits all the varieties, including "dál."

Lahore (3109-12), white, Kábuli, and ordinary.

Gujrát (3203-4), gram and Kábuli gram.

Local Committee, Muzaffargarh (3340-42) three varieties—white, ordinary, and Kábuli, with a reddish tinge.

Local Committee, Peshawur (3449-50)—1, ordinary gram; and 2, the genuine Kábuli variety, brought across the frontier.

LENTILS OR MASUR.

851.—Botanical name, *Ervum lens*, L., *Cicer lens*, Wild. Synonyms—Masúr, Mauri, Mori (Dera Ghází Khán), 'Adas (Arab).

This is the lentil or red pottage, the flour of which, says Dr. Birdwood, makes the Revalenta Arabica, the name of which is nothing more than a juggle of the words *Ervum lens*: "notwithstanding the illustrated advertisement of negroes digging at the roots of strange palms." The pulse is used as a dál, but is said to be heating and produce eruptions if too freely indulged in.

Specimens were shown by the following districts, Gurgaon (2563); Ambálah (the dál), (2672); Simla States—some of the samples are very *dark* colored—Bhaji (2715); Kotí (2755); Kunyár (2781); Balsan (2802); Tiroch (2815); Hushyarpúr (2914); Amritsar (2950); Gujranwalla (3719); Lahore (3113) with dál (3114); Gujrát (3213); Jhilam (3242); Shahpúr (Khusháb), (3261); Gugaira (3294); Muzaffargarh (3348); where its price is 32 seers per rupee. Dera Ismail Khán (dál), (3364); Dera Ghází Khán (3394); Peshawur (3347-48), a dark skinned variety, and "dál Kashmír" (3515), from Srinagar.

* Settlement Report of Kangra District, p. 56.

KULTHI.

852.—Botanical name, *Dolichos uniflorus*, Lam.; *Dolichos biflorus*, Wild.) Synonyms—Madras horse gram, Kulth.

This is a grain which is very little grown in the plains, but appears to be common in the hills; almost every one of the Simla Hill states exhibited a sample. It is the poorest kind of pulse, and grows on high meagre soils. It is in Kangra sown with "máh;" the only observable difference in the samples is, that some of them have the outward skin much darker brown than others, being almost black. Some specimens were sent prepared as a dál for human food. The grain is hard and indigestible, mottled with specks of darker color. Samples were shown from the following districts:—

Ambálah (2675); Simla States—Bhaji (2711); Kumharseñ (2732); Bagal (2740); Kothí (2753); Mahlog (2768); Kothar (2793); Kangra (2850); Hushyarpúr (2913); Amritsar (3044-45), exhibited both the grain and dál made of it.

RAWAN.

853.—Botanical name, *Dolichos sinensis*, L. Synonyms—Lobiya (Shahpúr district), Harwáñh chota (Amritsar), Rawañgan (Simla), Raoñgi, Rawáñgi (Kangra), Rawáñ reddish variety, (Gujranwalla, Jálandhar), Ro-íñ, (Amritsar); probably some of the varieties called *Dolichos catjang*, W., are included in these.

There were three beans in the collection, and a fourth, which is in the catalogue, I could not find; the specimens all bear the name of rawáñ, with or without a qualifying epithet, such as *safed*, *siyah*, &c., are also called rawáñgi in Kangra, and rewáñgun in Simla, which forms a diminutive of rawáñ and equivalent to chota rawáñ.

I. There is a *whitish* oblong truncated bean almost one-fourth inch long, and one-eighth inch broad, having a clear white eye surrounded by an irregular black line: this is called rawáñ chota safed; rawáñgi or raoñgi and lobiya. This is perhaps *Dolichos catjang*.

It is exhibited by Simla, Bagal (rewáñgan), (2742); Kangra (reóñgi), (2856); Amritsar (rawáñ chota safed), (3050); and (3261) from Khusháb in Shahpúr district (lobiya).

II. This variety is exactly the same in shape and size, and has the white eye surrounded by a black line but the bean is *red, or reddish-brown.* It is exhibited by—Lahore (3116); Gujranwalla (3180); and Muzaffargarh (3344); as rawáñ, without any qualifying epithet, probably it is the only variety known in these districts. The Amritsur specimen (2965) is called "rawáñ surkh." The Kangra sample (2856), included in the first variety may be also put in the lot, as the sample has a mixture of the two, white and brown. Jálandhar produces a similar red bean called rawáñ; samples of rawáñ came both from Dera Ismail Khán and Dera Gházi Khán (3365 and 3397), but they escaped notice, and I am unable to say to which variety they belong.

III. This variety is just like No. I, except in size, it is much larger, and the black band round the eye (which is the distinguishing mark of these varieties) much more broadly developed. It is the *Dolichos sinensis.* Two samples are sent, both called rawáñ. The same districts, which called *this* variety rawáñ, call the *other* varieties rawáñgi, rawáñ safed chota, &c.; in those districts, which call the small brown variety, rawáñ, without any epithet added, this variety is unknown, or would be called lobya. Specimens were sent from Kangra (2855); Amritsar (2964); I believe also from Bunnoo (3429); Peshawur (3451); both called lobya.

IV. Harwáñh siya, the black variety, is sent from Amritsur (3098). This I take to be black seeded *Dolichos.*

BAKLA.

854.—[3456]. Bákla, garden bean, *(Vicia faba, Faba major).* From Peshawur (kábli bakla) and Kashmír.

A darker colored bean, but otherwise quite similar 3488 (bakla.)

Bakla, and a bean called sawáwa, are mentioned as as pulses of Hazara, but no specimens were sent.

LOBIYA.

855.—[3530]. Botanical name, *Phaseolus vulgaris,* L.; *Ph. lunatus,* L. Red and white haricot beans (mixed) are exhibited from Srínagar, Kashmír: called in Kashmír dhákh.

KEO.

856.—Keo, kaiún or káli múng? *(Dolichos lablab ?)*

A dark-brown or black seed, not flattened but round and full truncated oval, having the eye the same color as the body, and situated at the end and not at the side like the *Phaseoli.* A sample was sent from Hushyarpúr (2912); Gujrát (3218).

MATTAR.

857.—Mattar, field pea (*Pisum arvense,* W.) Synonym—Matar Rewari (Amritsar) Karaiñ (Gujrát and Kashmír), Kuláwañ (Simla), Mattar Kála (Kangra).

Exhibited from Ambálah (2668); Simla, Balsan (2804); (kuláwan) Kangra (2857); (mattar kála) (2876). Amritsar, mattar and mattar rewari (the latter specimen is much mixed with chural (3037-3039); Gujrát (3221); (karain) Dera Gházi Khán (3395); Gugaira (3296); Muzaffargarh (3346); Peshawur (3446); Kashmír (3591-92); from Srínagar and Jammú.

MATTAR BARA.

858.—Mattar bára (*Pisum sativum,* W.)

This is the common pea familiar in Europe, it appears to be but little grown in the Punjab: there are only two samples from Delhi and Amritsar, both whole and split (2961-62).

CHURAL.

859.—Churál (*Lathyrus sativus*).

The grain is gray colored with minute specks of black, also a thin line of black passes all round the seed as if to separate it into two halves. The shape is highly irregular, scarcely two seeds are the same, but the general characteristic is that the seed is wedge-shaped, being attached to the pod at the end of the thickest side. It is used as a pulse, being made into dál, but is hard and indigestible.

The specimens are as follows :—

Amritsar (3038); Lahore (3127); with dál of do. (3128).

860.—Múng Ladákhi *(Cicer sp ——— ?)*

This is an unique specimen sent from Ladákh, by H. H. THE MAHARAJA OF KASHMIR (3536); it is not "múng," and has the pointed seed which indicates it to be a *Cicer;* it is not unlike gram in shape, but is very much smaller and is of dark brown color. Its selling price is 32 seers per rupee.

ARHAR.

861.—Botanical name, *Cajanus flavus; Cytisus cajan,* Wild; *Cajanus indicus,* Spreng. Called also kohlú or kehú (Simla States), dángrí (Gujrát), and dhíngra, or kúndí in Kangra.

A less esteemed pulse than the others: it is said to be liable to produce costiveness. DRURY, however, mentions that natives esteem this plant third in the order of the Leguminous grains.

Specimens were sent from—

Delhi (2540); Ambálah (2674); Simla States—Bhaji (2712), where it is called kohlú or kehú (2717); Kangra (2852); Amritsar (3015), with samples dál (3044); Lahore (3121), Gujrát (3220), dángrí.

KUNDI.

862.—Botanical name, *Cajanus bicolor?* Synonyms—Kundi (Kangra), Dar mothi (Kashmír.)

There are two varieties, but in the samples sent both are mixed indiscriminately. The seeds are smooth, oval, and slightly flattened, of a white or brown color.

Samples were sent principally from the hill districts, as follows:—

Simla States—Bhaji (2715); Bagal (2743); Kangra (2853); Kashmír, Srínagar (3546), *(dar mothi)*.

863. — Peas from Zangskár. Sradma or Sranma (Thibet). Rev. H. A. Jaeschke.

These are small blackish brown peas, probably some species of *Vicia?* These are cultivated in Spiti and Zangskár, but not in Lahaul, because it is not yet the custom, and there are no fences to protect them.

SOY BEAN.

864—Bhút (*Soja hispida*).

Several samples were sent from the Hill States, but they were not found in the collection; the identification is on the authority of Dr. Cleghorn.

I conclude the mention of pulses with a table showing the relative quantities of nitrogenous matter contained in the various species. The abundance of this element renders them so suitable for forming an article of diet, together with substances abounding in carbonaceous or starchy matter.* The quantity of nitrogenous matter in pulses varies much. In the Soja or Dolichos it is the highest in any known vegetable substance; in gram it is very much less, as will appear from the table. The quantities given are averages from several analyzed samples.

Number of specimen from which the results were obtained.	Name.	Nitrogenous matter.	Starchy matter.	Fatty or oily matter.
		In 100 parts; varies in specimens from different parts of India, from		
1	Gram, *Cicer arietinum*, ...	18·05 to 21·23	60·11 to 63·62	4·11 to 4·95
3	Arhar, *Cajanus indicus*, ...	19·83 to 20·38	61·90 to 64·32	1·32 to 1·86
2	Mattar, *Pisum sativum*, ...	21·80 to 25·20	58·38 to 62·19	1·10 to 1·12
4	Lentils, masúr, *Ervum lens*, ...	24·57 to 26·18	59·34 to 59·96	1·00 to 1·92
1	Churál, *Lathyrus sativus*,†	31·50	54·26	0·95
2	*Lablab vulgaris*, ...	22·45 to 24·55	60·52 to 60·81	0·81 to 2·15
1	Rawán, *Dolichos sinensis*,‡	24·00	59·02	1·41
2	Kúlthi, *Dolichos uniflorus*, ...	23·03 to 23·47	61·02 to 61·85	0·76 to 0·87
1	Guwár,§ *Cyamopsis psoraloides*, ...	29·80	53·89	1·40
3	Bhút, *Soja hispida*, ...	37·74 to 41·54	29·54 to 31·08	12·31 to 18·90
1	Urd,‖ *Phaseolus radiatus*, ...	22·48	62·15	1·46
2	Múng, *Phaseolus mungo*,...	23·54 to 24·70	59·38 to 60·36	1·11 to 1·48
1	Moth,¶ *Phaseolus aconitifolius*, ...	23·80	60·78	0·64

* Doctor Forbes Watson has published a most useful table, showing the properties of nitrogenous substances which can be combined to the best advantage with carbonaceous ones, that is of pulses to be combined with cereals, arrow-root, sago, millets, and the like. By a simple formula we can find out the quantity of a pulse that should be added to a carbonaceous substance, provided only we know from previous analysis the amount of carbonaceous and nitrogenous matter in each, from which we can deduce the proportions of carbonaceous to nitrogenous in each, representing nitrogenous as unity.

Then to find the quantity of one substance to be added to the other we have this formula:—

Let the proportion of nitrogenous to carbonaceous in the given substance be $m : 1$.

Let the proportion do., do., in the substance required to be added be $n : 1$.

Then the standard proportion or best possible combination (which is 6 Carb. : 1 Nit.) $= p : 1$.

Let the number of parts in the given substance be a and the number required to be added be x, then

$$x = \left\{ \frac{m\,(p+1)\,(n+1) - p\,(n+1)\,(m+1)}{(p-n)\,(m+1)} \right\} a$$

$$\text{Or simplified, } x = \left\{ \frac{(m-p)\,(n+1)}{(p-n)\,(m+1)} \right\} a$$

this will be clear from an example. Let it be required to know what proportion of a pulse, say gram, should be added to a hundred parts of arrow-root to give the best combination. By analysis we know that the proportion of carbonaceous to nitrogenous in arrow-root is 165·5 : 1, and in gram is 3·8 : 1, then in the formula m will be represented by 165·5; n by 3·8; p by (the standard known) 6 and a by 100 : so

$$x = \left\{ \frac{(165{\cdot}5-6)\,(3{\cdot}8+1)}{(6-3{\cdot}8)\,(165{\cdot}5+1)} \right\} 100 = \left\{ \frac{765{\cdot}60}{366{\cdot}96} \right\} 100 =$$

$2{\cdot}09 \times 100 = 209{\cdot}0 =$ the number of parts required, that is, that 209 parts of gram to 100 parts of arrow-root makes the best combination. This formula is of great value in settling jail and hospital dietaries.

† Calcutta specimen. ‡ Bombay specimen. § India Museum, specimen from Poona. ‖ Bombay specimen. ¶ Calcutta specimen.

IV. MISCELLANEOUS GRAINS AND SEEDS USED AS FOOD.

These embrace several articles of considerable importance: those are the varieties of buckwheat (Fagopyrum) that cannot be conveniently included in the foregoing classes, and there are several Amaranthine plants (síl, &c.,) that are much used for food, especially by Hindús on their "bart," or fast days, a few of these seeds are wild.

BUCKWHEAT.

865.—Two varieties, an angular sharp cornered variety (*Fagopyrum polygonum*), and one with rounded edge (*Fagopyrum esculentum*,).

The grain is eaten by Hindús on fast days. It is a very hardy grain and will grow at great heights.

There are considerable differences noticeable in the names of buckwheat.

Wherever it is found in the plains, it is called daraun. The following specimens will show how the names vary in different localities:—

Simla, Bhájí (*F. polygonum* or *F. emarginatum*), úgla or ugal.

Simla, Kumharseń (*F. esculentum, F. polygonum*), pháphra, daraun.

Simla, Mahlog (*F. esculentum*), jhákí or kathú.

Simla, Sirmúr (*F. polygonum, F. esculentum*), úgla, pagua.

Kullú (*F. esculentum*), kathú or brés.

Kashmir (*F. polygonum*), trámbah shirín.

The cultivation is confined to the hills, and forms an autumn crop: the seeds yield a hard bitter and unpalatable bread, which is said to be heating: it is only eaten in the plains during the "bart," or fast days, being one of the "phaláhas," food lawful for fast days. There seems to be little or no difference in the taste, &c., of the two varieties, but the appearance is dissimilar, one having sharp edges to the seed, the other being rounded off.

AMARANTHS.

There are several species of this tribe, the leaves of which are utilized as vegetables, and the small seeds as grain: these are ground up to form flour, or are treated as a pottage: they grow in the autumn. The species are—

866.—[ ]. Chaulai (*Amaranthus frumentaceus*). Sirmúr, Simla.

867.—[ ]. Síl, siyul, or sariárá or salyára (*Amaranthus sp*———?). Kangra.

868.—[ ]. Siyul or "kirín," from Srínagar, Kashmír.

869.—[ ]. Báthú. Sirmúr.

This is also an amaranth, and different from the batua or báthú of the plains, which is *Chenopodium album*; the grains are whitish in color and resemble the well known Russian "semolina." Dr. Jameson mentions two species, the red and yellow, called chúa, and cultivated in Kullú (*Amaranthus anardana* and *A. speciosa*).*

870.—[ ]. Black seed, siyal súya.

The other kind of síyul or sil, called sil siyáh, is a small glossy black seed of the *Celosia cristata*, the well known seed "cockscomb" of our gardens.

There are some other grains which I have not identified.

871.—[3401]. Símúkh, a species of amaranth. Dera Ghazi Khan.

It sells for a rupee a maund, and grows on the banks of the Indus.

872.—[3410]. Nángirá.

873.—[3404]. Koria.

This sells at 25 seers for the rupee: perhaps a species of *Penicillaria?*

874.—[ ]. Bihú. Kangra Hills.

These last four are all wild or spontaneous produce.

GRASSES.

A few of these are used in times of famine for food, as the "markan" grass, the wild sawánk, and others. The following specimens were in the collection as fodders for cattle, some few that are useful in manufactures are noticed in the class next following.

875.—[ ]. Dúbh. Hissar.

This is the commonest grass, and that which is grown for lawns, &c., its dry creeping stems spread out and take root at the joints, it is the *Cynodon dactylum*; and more commonly called "khabal" in the Panjab.

This is the "dúrbá" grass of Sanscrit authors. In the Athávaṇa vedá it is thus apostrophized. "May Dúrbá which rose from the water of life, which has

* Physical Aspect of the Punjab, J. A. H. S. Vol. viii, p. 188.

a hundred roots and a hundred stems, efface a hundred of my sins, and prolong my existence on earth for a hundred years." The flower of this grass is a most beautiful object under the microscope.

876.—[ ]. Sawánk, the wild grain. (*Panicum colonum*). Hissar.

877.—[ ]. Gandhi. (*Andropogon sp*——?). Rohtak.

878.—[ ]. Anjan (*Pennisetum cenchroides*).

In Rohtak grass sells during the rains at from 4 to 10 maunds the rupee.

879.—[ ]. Phalwa. (*Andropogon Bladhii.*)

880.—[ ]. Seed of dhaman (*Pennisetum cenchroides*). Sirsa.

The seeds are little conical brushes of bristles, the grass is esteemed extremely fattening for cattle.

Grass from the Rukhs of Lahore district the vernacular local names are as follows:—

Khabal (*Cynodon dactylum*).
Dháman (*Pennisetum cenchroides*).
Palwáń.
Chímbar (*Eleusine flagellifera*).
Nunák.
Salyára.
Dhela (*Scirpus maritima*).
Khavi (*Cymbopogon Iwaranchusa*).
Khauń (*Panicum maximum*).
Kúrth.
Kharm.
Dib (*Erag. cynosuroides*).
Lúkhí.
Mainá.
Itsit.
Indrání.
Sih char.
Gatwá.
Ghatti (*khatti*).
Panní.
Sír.
Kora (*Eragrostis sp—?*).
Murk (*Cyperus sp—?*).
Sochal.
Mús giah.
Surálá.
Leya (*Cenchrus echiatus*).
Laili.
Agya ghás.
Barau (*Sorghum halipense*).
Tándala (wild rice).
Sarkara (*Saccharum spontaneum*).

Grass is rarely if ever cultivated for grazing purposes as it is in Europe, and it is but seldom cut and stacked as hay; but in the Rakhs and in the "bar" tracts during the rains, the whole surface of the plain is covered with grass. There were several sorts —no less than thirty—each with its distinctive name, collected in the rainy season near Lahore.

The rapid growth and subsequent dryness render many Indian grasses unfit for pasture at the end of the year. This the inhabitants remedy by burning down the old grass so as to allow the young blades which sprout up to afford fodder for the cattle.

Grasscutters, who provide horses, usually search for and collect the dúbh grass (*Cynodon dactylum*).

In a note at page 421, of the "Illustrations of Himálayan Botany," Dr. Royle mentions that the grasses of Hariána (Sirsa and Rohtak);—and indeed it is true of the Rakhs generally—consist of species of *Panicum, Pennisetum, Cenchrus, Chætaria, Vilfa, Dactyloleníum, Chloris, Eleusine, Achrachne, Poa, Eragrostis*, and *Andropogon*: species of *Saccharum*, and *Rottbœllia* should also be added.

881.—Methi or methri, fenugreek (*Trigonella fœnugræcum*).

This is a pot herb, and is eaten by all classes, and is much esteemed.

882.—Sowa (*Anethum sowa*). Syn.—Soyá, shibt.

This is a strong flavored herb, used rather for flavoring than as an esculent by itself.

883.—Pálak (*Beta bengalensis*).

Commonly eaten boiled with ghí and spices, &c.

884.—Khúrfá (*Portulacca sativa*).

This also makes a salad.

885.—Lúnak or loniya (*Portulacca oleracea*).

FODDER PLANTS.

Besides various grasses, other fodders are employed: in one place a clover or lucerne, "shotal," is grown; also *sinji*, but this principally by Europeans for their horses and other cattle. Cattle are usually fed (besides grass) on bhúsá, or as it is called in Punjabí "túrí," the chopped straw of wheat and barley. Besides which they get "karbi," the dried stalks of jawár (*H. sorghum*); this latter when green and fresh is called "charrí." Chopped leaves of the bér (both *B. vulgaris* and *B. nummularia*), called mulla, are much used, and are said to be fattening. *See* also page 150, No. 589.

The specimens were as follows:—

886.—[ ]. "Shotal," clover or trefoil. Hazara district. Syn.—Shaftal.

There is an interesting paper about the lucernes of Afghanistán and Kábul, in the A. H. Society's Journal, Vol. i., p. 105.

887.—[ ]. Sinji. Lahore.

A species of trefoil or lucerne (*Medicago*); grown for horses' food.

888.—[ ]. Turnips. (*Brassica rapa*).

The following is from Dr. Henderson :—

"In Shahpúr and one or two other districts, turnips are grown very extensively for feeding cattle during the cold weather, and they often attain a size such as I have never seen them do at home. It is believed that in many districts, this root is scarcely at all grown by natives, and it is very desirable to introduce it. I shall be glad to supply seeds in any quantity, to those who wish to distribute them, the cost will probably be about four annas per ℔. The season for sowing is during the month of September. A native of Shahpúr who cultivates a considerable extent of ground, and takes a great interest in all agricultural improvements, has furnished me with information regarding turnips. The following is a translation of his letter.

"In good soil 2½ ℔s. of seed are allowed to each beegha, and 4½ ℔s. if the soil is bad; during the growth of the crop, three top dressings of manure are given; a plough being run through the field so as to loosen the ground, but care being taken not to injure many of the plants. If the soil is very good, and the crop seems to be flourishing, only one top dressing is given.

"If rain falls abundantly, the ground will require to be flooded only three times; if no rain falls nine or ten waterings will be required.

"A good field of turnips will yield 640 maunds per beegha, and will sell as it stands on the ground, at Rs. 24 in a dry season; but if abundant rain should fall, there is less demand for green fodder, and a beegha of turnips will then fetch only Rs. 14.

"One good beegha of turnips and 14 maunds of chopped straw (bhúsá) will feed two pairs of bullocks for nearly three months.

"At a well where six pairs of bullocks are constantly working, so as to irrigate night and day, the proportion of ground sown with turnips for feeding the bullocks during the winter months, is eight or nine beeghas.

"After turnips, tobacco is not usually grown on the same field; opium, Indian corn, and cheena, are the usual crops."

889.—[ ]. Bhúmphor (*Philipœa calotropidis*). Syn.—Khúrjín, Khalátrí.

This very curious plant is figured in the annexed plate.

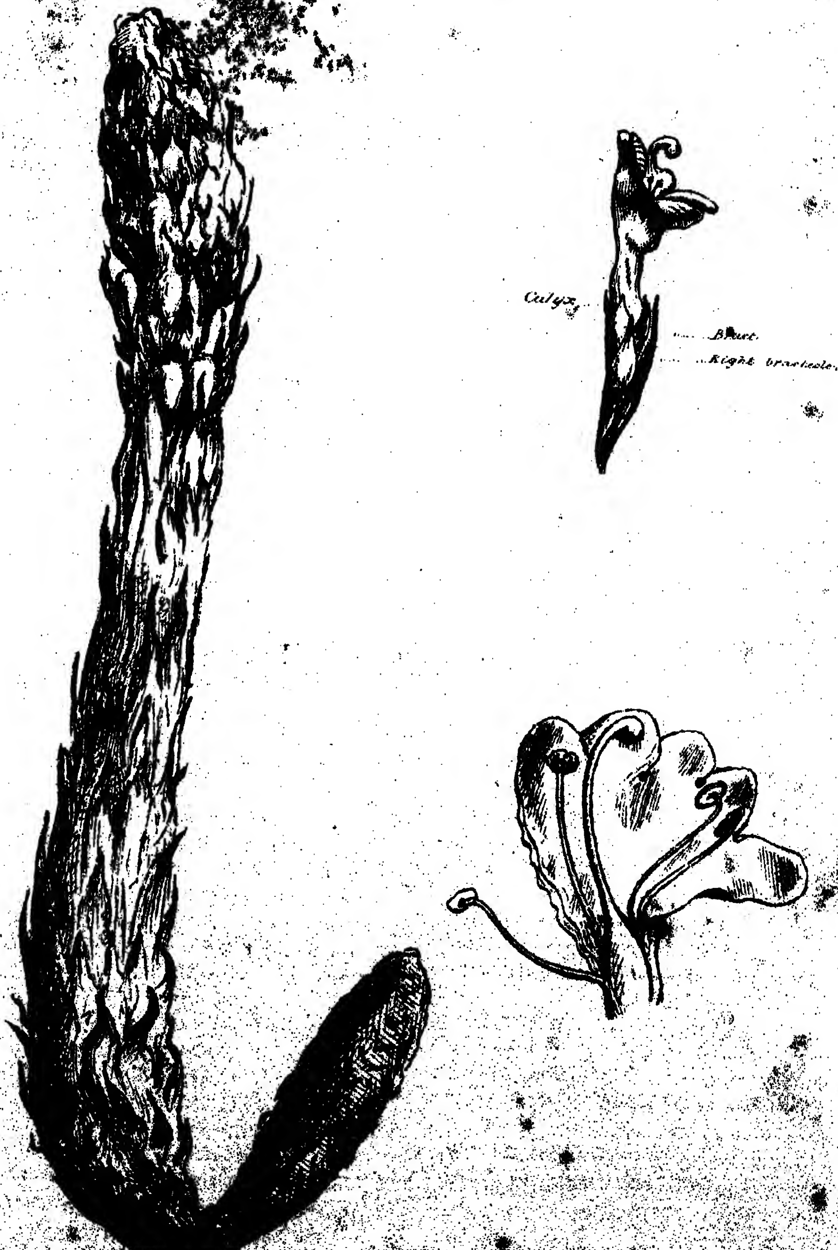
"The *Philipœa calotropidis** is mentioned in Edgeworth's 'Florula Mallica,' as growing on the roots of *Calotropis* only, in the Múltán division."

Mr. Edgeworth mentions that it differs from "*P. lutea* in the anthers which are mucronate, while in this they are obtuse." I believe both species are common in the Shahpúr district, although I did not, whilst at Shahpúr, know the distinction between them. The idea that the plant only grows under a bush of *Calotropis*, which lead to Mr. Edgeworth's fixing the above given name, is erroneous; the plant has frequently been seen where no calotropis was near. It has been found in Shahpúr, and as far north as Kalábágh, and south, half way down Sindh. Mr. Edgeworth got it in Ambálah. "Nothing can be more remarkable than the habit and appearance of this plant: it grows like a parasite from seed which attaches itself to any long thin fibrous root of some other plant which happens to cross its locality in the soil: the seed lies dormant until such a root comes in the way: it then germinates and throws up a number of thick fleshy shoots, which are subterraneous; the thick tops of these shoots alone project above the soil. They are observed to be covered all over with little bracts; and above these, yellow flowers, shaped like a fox-glove, spring out: as soon as the sun gets hot the plant withers."

In Muzaffargarh it is said to be used for a fodder for goats and oxen, but not for camels. Its use in this respect is doubtful. I have only included it in the class of Fodder plants, to avoid omitting so interesting and curious a plant.

"In Shahpúr the plants grow on the roots of the *Salvadora oleoides*, on all the species of tamarisk, but chiefly on the *Salvadora*, and I have never found them on the *Calotropis*, though I have repeatedly dug up the plants, and with great labor traced the filament of root on which the parasite was growing to the parent stem. The only native name I have ever got for the plant is *gidar ki tamákú*, jackal's tobacco: by some natives it is said to be poisonous, and by others it is said to be a remedy for hydrophobia. I have constantly found the plant filled with maggots, and on them it certainly has no poisonous effect. In Stewart's "Flora of the Peshawar Valley," and in Aitchinson's "Jhelum Flora," the plant is not mentioned, and I have never seen it in the districts of Jhilam Gujrát, Sealkot, or Lahore. At Shahpúr, and in fact, wherever it is found, it is a very striking object: the bare hard soil near a *Salvadora* bush, cracks, and in the course of a night the place is studded with what resembles huge flowering heads of digitalis, each

* Communicated by Dr. G. Henderson.


Calyx,
Bract.
Right bracteole.

with a stem more than an inch thick, and without any regular leaves. These flowers soon wither, but a succession is kept up just as in the case of mushrooms; and I believe they appear at intervals all the year round."

Camels are fed in parts of the Punjab in great numbers, they delight especially in "láná," plants of the Salsolaceous tribe, which are also useful for burning to get soda: there is often quite a rivalry of interests over a patch of salsola land—the camel feeder wants it for his animals, and the soda burner for his furnaces.

The whole subject of cultivation of fodder plants ought to command a good deal of attention, when it is remembered how much the health of the population and our troops depends on their being supplied with milk and meat, which is obtained from animals that have been properly fed. It is a notorious circumstance that cattle, and especially sheep, are allowed freely to feed on the night soil removed from latrines; and Dr. Birdwood says that, in Bombay even, *horse-dung* is given as fodder to oxen and sheep; the result is obvious, the milk is undrinkable, and the flesh gives rise to a variety of painful diseases.

HOPS.

The last section in the Agricultural Class will be a brief one, for hop cultivation in India is still only experimental, although a measure of success has been attained in the Dehra Doon and elsewhere. The first trial of hops was made with plants obtained by Lord Auckland, at Dehra. At Kyelang, in British Lahaul, the missionaries have attempted the growth of hops; the same attempt has been made for the Simla and Kasauli breweries, otherwise the hops in use at the hill breweries are imported. The hops are well suited as to their season of flowering, as they come into flower just when the rains cease, and so there remains the dry month of October, during which they can be dried, packed and stored.

Three samples of hops only were exhibited.

890.—[ ]. Hops, from Hazara.

With regard to hops at Hazara, the Executive Engineer, Capt. Blair, has kindly communicated the following:—"I found that Captain Davis had got some plants planted in the Executive Engineer's garden at Abbottabad, and I had them planted out in the proper way in 1863 and 1864. They grew remarkably well, and I sent a maund of these flowers to the Murree Brewery, which Mr. Dwyer, the Manager, considered first class, and as good as the home ones.

"The plants grow beautifully, but do not flower much so as to make the produce a paying speculation, although it may have been through my ignorance as to their proper treatment.

It is hard to get them through the heat at Abbottabad during June, but when the rains commence the creepers grow amazingly fast, and I think there is not a sufficiency of hot weather after the rains to allow the plants to flower properly."

891.—[ ]. Hops, from Kasauli.

892.—[ ]. Hops, from Simla. Mr. Geo. Jephson.

The bitter and odorous resinous substance of the hop (*Humulus lupulus*) consists of an acid ethereal oil, an aromatic resin, wax, extractive, and a bitter principle called Lupuline. By pressure the heads yield a light green acrid oil; the roots of the hop have been used as a substitute for sarsaparilla, and the young shoots eaten as a vegetable.*

In the fifth volume of the Transactions A. H. S., p. 46, an account is given of hop culture; which, as the volume is now rare, I have extracted *in extenso*.

"*Observations on the Culture of Hops.*—The first subject for the consideration of the planter is that of soil, whether he may possess any of a quality sufficiently rich to favor the growth of this plant, for the cultivation of it being expensive, unless the produce should make a suitable return, a certain loss must be created. The most genial soil is probably a loam or marl of a depth of at least three feet, and if the substratum is of a porous nature, it will be more favorable for the growth of the plant for the following reason:—that the root will run with greater facility; and that the moisture will more speedily escape, for while it is retained in the soil, it chills the root of the plant and checks its growth, on this account a clay soil is too tenacious in its natural

* Lindley, Veg. Kingd. 365.

state, but when improved by a copious dressing of free chalk, which not only opens the pores, but chastens it, the plant will grow in it freely, and in my own experience I have known it to succeed so well, that the plant would take a sixteen foot pole with more ease than the twelve foot pole, which it had been previously supplied with.

"The next thing to which the planter's attention should be directed is situation, as strong winds are injurious, particularly those from north to east. It is highly desirable to have the plantations as much sheltered from that quarter as possible, so as to escape the early ray of the morning sun coming on the plant before the dew has evaporated, as insects will be produced by the warmth of the sun. The plantation should be sheltered as much as possible from all winds, as the fruit becomes discoloured when shaken much by the wind, and although intrinsically it is not injured (the virtue and strength being in the farina) the sample is not so good to appearance. I now come to the culture which is practised in England. The process in the first place commences with preparing the ground, by trenching it from two to three feet deep according to the soil. When this is done, the ground is set out in squares of six feet, leaving a stick standing at every square, to mark the place for planting. This is done either with nursery plants, or with cuttings which are the superfluous parts of the roots taken off in the spring, and trimmed to the length of four inches. When cuttings are used, five are usually put into a hole, made with a large dibble, the lower points being placed together, and the soil over the top pressed hard round with the hand. When nursery plants are used, three will be found sufficient; some planters use one way and some another, but I always gave the preference to cuttings, for if they succeed, a year's growth is gained by it. The first operation for the year is digging, which commences when the weather becomes dry in February; the implement used for the purpose is a prong and not a spade. If favored by weather, a man will dig an acre in eight days upon the average. The next process is that of laying out the poles, which is taking them from the stack and placing the heel of the pole close to the hill to be in readiness to set up. Two poles is the accustomed number to a hill, but where the hill is very strong a third is sometimes used. Next comes the opening and cutting, that is, clearing away the old hill that was collected round the plant the preceding year with a hoe, and cutting from the stalk all that part which grew from it the former year (it is from this the cuttings are collected); and after thus clearing, a little earth should be drawn round it again to prevent the bleeding. The polling next follows, which is done when the bind begins to shoot, by making a hole with a crowbar, and then forcing the pole into the hole. When the bind is sufficiently strong to select that which appears to be the best, it is brought to the pole, viz., three to each pole, and twisted round the pole with the sun, and lightly tied with rush or Russia matting. After the first tying, they should be constantly watched and fresh tied, for if they are neglected they will slip down the pole, and when they are above the reach, a back ladder is used as soon as sufficient binds have been selected for the poles, the remainder are torn off, and with a hoe some earth is drawn round the hill to stop the bleeding, which would much weaken the plant. Hilling comes next in succession, this is done with a shovel, by throwing a heap of earth round the plant in a conical form to the height of about 18 inches from the level of the ground to the top. The plant being now set in order for growing, nothing further is to be done until it arrives at maturity, but to keep the ground clean. As the various operations will have trodden the earth, it should be loosened again, which is done with an instrument made for that purpose with the hoe at one end and a prong at the other, and is used like a pick-axe. When the ground is turned up with this instrument, it should be knocked about to break all the clods, and render it smooth again. When weeds appear, it should be kept hoed, but when the hop is in fruit, the hoe should not go deep into the ground, or it will disturb the fibre which runs on the surface and nourishes the fruit. Next comes the picking, which is done by drawing the pole (after cutting the bind about a foot from the ground) and laying the pole across a basket into which the fruit* is dropped. As fast as they are picked, they are taken to the kiln to be dried, where they are spread on a hair cloth, with a charcoal fire underneath. Some kilns have French holes made like an inverted funnel, and some English. I prefer the French. The hair cloth should be at least eight feet from the fire. The frame should be lathed and plastered. Next comes the bagging, which is done by men getting into the bag and treading them hard, having a half hundred weight with which they bump as they walk round. The hops should be turned once or twice in the store room to cool them thoroughly before they are bagged. Next follows the sale, and last of all the collection of the money."

* Flower.

REPORT ON AGRICULTURAL PRODUCE.

SECTION A. CLASS III.

DIVISION I.

JURY.

Col. Lake, *Commissioner of the Jálandhar Division.*
Mr. R. Egerton, *Commissioner of the Lahore Division.*
Dr. Neil.
Dr. Gray, *Superintendent Central Jail.*
Mr. Baden Powell.
Nabbi Bakhsh.
Captain Ogilvie, *Assistant Commissary General.*

Reporter—Mr. Dallas, *Inspector General of Prisons.*

The duties of the Jury were confined to that portion of this class which is comprised under the head, Agricultural Produce, viz., cereals, millets, pulses, grasses, oil seeds, and hops. Subsequently, to the appointment of the Jury, oil seeds were removed from this Sub-division.

Although the class is one of the most important, and the number of specimens exhibited was large, yet there were comparatively few articles which attracted very much attention. The collection represented the Agricultural Produce of the whole province; and as the same grains are cultivated more or less in every district, it follows that though the number of specimens exhibited was large, yet the number of different kinds of articles was comparatively small.

The Punjab, with reference to its soil and climate, may be divided into four regions, in each of which some products may be localized or there may also be found some peculiarity of growth, form, or properties, in kinds of produce which are otherwise common to all.

The regions may be divided thus :—I. Well watered districts—whether irrigated by canals, wells, rivers, or abundance of rain—the soil of these is chiefly alluvial, such for instance are the districts of Lahore, Gujranwalla, Amritsur, Gujrát, Jálandhar, Ludianah, Ambalah, Delhi and Peshawur. This of course forms the largest division, and the samples may be looked upon as mere duplicates from the various districts of this division. The collection of rices from the Peshawur district is however to be excepted, for though the soil and abundant irrigation of the valley place it rightly in this division, the great productiveness of rice places it in some degree of resemblance to the Kangra valley, which is legitimately noted in another division.

II. This Division consists of those districts whose soil is arid and sandy, which are not well watered, where rain falls but sparingly, such as Múltán, Muzaffargarh, Shahpúr, or Gugaira. Sirsa properly belongs to this division, but the products exhibited are chiefly

those grown on the bank of the Ghaggar river, where there is abundance of moisture, and consist of rices, pulses, and cereals, resembling closely the products of the first division.

III. In this Division may be placed the intramontane and submontane valleys, partaking partly of the character of the hills in their climate, and partly of the nature of the 1st division in their being well watered. Such districts are Kangra, Gurdaspúr, Hushyarpúr, and perhaps, Sealkot. In this region may also be classed Kashmír.

The Kangra valley is the type of this class, and is important, as it constitutes the rice emporium of the Punjab.

IV. The Fourth Divisien is purely mountainous, and includes Simla and its Hill States—Sirmúr, Tiroch and others; also Spiti, Ladákh, Kúlú, and Lahaul.

This rough Division of the various districts may easily be completed, by considering the geographical and climatic characteristics of any district, which can then be referred to one or other of the Divisions.

The importance of the class of Agricultural Products, is obvious, when it is remembered that grain and pulse in some form or other enter very largely into the diet of the whole population of the Province. It is remarkable that the consumption of some of the articles of this class is confined almost entirely to certain classes of the people: for instance, the inhabitants of cities consume principally wheat, rice, and to a small amount, maize: the expensive varieties such as white wheat, or bárah, the scented rice of Peshawur, being confined to the richer classes: the villager and cultivator seldom if ever use wheat, the value of the crop inducing them rather to sell than retain it for home consumption. Barley, however, millets, and pulses are chiefly used by the villagers.

A brief specification of the principal articles exhibited, together with the remarks of the Jury, may now be given.

WHEAT (*Triticum vulgare*).

Twelve samples of red and sixty-two of white were exhibited. Although not in any way inferior, yet the red wheat would appear to hold a very much lower place in the estimation of natives, and to sell at a cheaper rate than white. The former being consumed by the poorer classes and the bulk of the population, whilst the use of the latter is restricted to men of wealth. There is little to be said regarding this description of wheat. The samples generally were good.

Several varieties of white wheat were exhibited. The Gilgit or paighambri, a small round fancy grain,—also called "Múltání" or "Rai Munír" (from the places where it was first grown: there were also dáúd khán, ghoni, kabr and vadának (kanak dágar, Shahpúr), the last named being a particularly fine large grain. The Yásín wheat, from Kashmír, was also remarkably good. Some specimens of red and white wheat sown together were exhibited under the name of "jogyáñ."

BARLEY (*Hordeum distichon*).

Fifty-one samples, generally of a good quality were exhibited. There are two kinds—*Hordeum hexastichon* and *Hordeum cæleste*—the last is beardless. The barley from Spiti (called "surmo," "zezi" and "sowa") and from Lahaul was worthy of note. The beardless variety was also exhibited from Spiti. Paighambri, or black barley, was sent in from Gugaira and other districts. Hazara exhibited a fine barley, having a translucent, wax-like appearance,

and a greenish color. A sample of this sort of barley, the grains of which were remarkably fine, was also forwarded from Kashmír. It is worthy of note that though the Kashmír grains both wheat and barley, are of excellent quality, yet they enter but sparingly into the diet of the ordinary population.

OATS (*Avena sativa*).

Two samples of those were exhibited, one from Hissar, where the establishment by Government of a large cattle farm may perhaps account for their cultivation, and the other from Ambálah, where they are called javi. The samples were of good quality. Wild oats are common in Jhilam and Shahpúr, but are useless.

MAIZE, INDIAN CORN (*Zea mays*).

Thirty-five samples of the white, red, and yellow varieties of Indian corn, or makkai, were exhibited, one specimen from the Hills—yellow—was remarkably good, quite equal to that produced in America—the white variety was inferior, and so was the red. These are never considered equal to the yellow, and very rarely in the American markets realize as high a price. It would not seem however that they are less esteemed in this country ; maize enters very largely into the dietary of the people of the Punjab, especially those inhabiting the hills and submontane districts, indeed it may be considered peculiar to this province, as the people of Hindústán would appear to consume but little of it. Doubtless the hardy nature of this cereal and rapidity with which it is matured recommend it to the people of the hills : it does not however keep well, being quickly attacked, especially the white variety, by insects.

RICE (*Oryza sativa*).

Of this grain ninety-seven samples husked, and forty samples unhusked, were exhibited from the various districts. The varieties as given in the lists are extremely numerous, but it is questionable whether all of them are in reality varieties, and not merely the same article recognized in different localities under a different name. That the latter may be the case will be easily understood when the varieties of dialect and the localization of rice producing tracts are taken into consideration. The chief varieties given may however be stated. Rice without the husk is called *brinj* or *cháwal;* whilst paddy or unhusked rice is called *chhona* (Panjábí), or *dhán* (Hindústání).

Básmati is the first quality of good rice; and indeed the *real* básmati from the Kangra valley, with its large white and fragrant grains is a most beautiful product, it is scarcely less celebrated than the *bárah* rice of Peshawur. In the plain districts the coarse rice commonly grown is called *múnji;* other rices met with in the bazar, of second and third quality are *begami* and *samoja* also *sohn pat:* a fourth class, is the red skinned wheat called *sathi*, also "*sharbati*" and *chinwa lál;* this is inferior.

In Peshawur the varieties of rices are called *doába, shughá, záfráni, jyotshi, kaneri*, and *lukh*, or coarse rice.

In the hills rice is generally of two qualities, the first of which is called jhinjan and the second rehání.

Both the Kangra and Kashmír valleys have a great variety of names for rice, which have been given already.

Some of the specimens from Kangra were remarkably fine. The Kangra people state

that they have as many varieties of rice as there are days in the year. Several varieties, kharcha, sabza, son karcha, munjí, and sukhanand were sent from Sirsa, and the Jury consider the specimen of Peshawri rice introduced in the Sirsa district by Mr. Oliver, the Deputy Commissioner, worthy of note.

Kashmír sent four specimens with their local names—básmati, sukhdás, sháli-kanú, and shali shírímal—but they do not demand any special notice.

MILLETS.

A very large number of specimens of these were exhibited, the most important being the following:—Jawári (*Sorghum vulgare*); kangni, (*Pennisetum italicum*); chínáñ (called chijé, in Spiti and other hill districts), (*Panicum miliaceum*); bájra, (*Penicillaria spicata*); sawáñk (*Oplismenum frumentaceum*); kodra (*Paspalum scorbiculatum*), sometimes in the hills called kodram, and mandwa (*Eleusyne coracana*), sometimes called mandal and chalodra; a specimen of imphí (*Sorghum saccharatum*) was also exhibited.

Specimens of amaranthine grains were exhibited called chaulai (*Amaranthus polygamus*) and bátua (*Chenopodium album*), this latter would appear to be called sometimes jugul, or síl. The grain called sariára is also very similar to, if not identical with, síl. There are two varieties of síl,—síl siya and síl safed. The number of amaranthine plants grown is Kashmír is considerable. It is to be regretted that the Kashmír samples did not come under the notice of the Jury. The amaranthine grains were chiefly from the hill districts. Samples of buckwheat (*Fagopyrum polygonum*) were also sent from the hills, and in one or two cases (Amritsar and Hushyarpúr) from the plains. The native names of buckwheat vary much according to locality; that from Kumharseñ (Simla) was exhibited under the name of dharauñ: that from Mahlog (Simla) as jháki or kathú; that from Simla and Sirmúr as úgla; at the latter place also called pagua. Kúlú exhibits it as kathú and bress, whilst Kashmír calls it taramba-shírín. Pagua and úgla would seem to be varieties, the one having the edges of the grain rounded, and the other having them angular.*

PULSES.

The specimens and varieties of pulses were very numerous. 185 samples in all came under the notice of the Jury. The chief varieties were lobiya (*Dolichos sinensis*); urd, máh or mash (*Phaseolus radiatus*); múng (*Phaseolus mungo*); channa (*Cicer arietinum*); kulthí (*Dolichos uniflorus*); rawáñ, (*D. sinensis*, var., perhaps *Catjang*); kúndi (*Cajanus bicolor*); guár (*Cyamopsis psoraloides*); moth (*Phaseolus aconitifolius*); churál (*Lathyrus sativus*), called in Hindústání *khesari*, and mentioned in the Muzaffargarh list as mattar, sometimes it is also called massar; keo (a black bean, doubtfully identified); masúr (*Ervum lens*), the red pottage of Scripture; and bákla, (*Faba vulgaris*). One sample of peas (*Pisum arvense*), grown from acclimatized seed, was exhibited from Delhi.

There were three varieties of moth, viz:—Black, or *moth siya;* white, or *moth safed;* and green, or *moth sabz;* so also were there three varieties of múng—black, white, and green—the white or rather golden yellow variety is perhaps the *Phaseolus aureus* of some writers. Three varieties of gram were exhibited, a perfectly black gram from Ambálah, the common red gram, and the Kâbuli or white gram: a sample of gram actually brought from Kábul appeared to differ from that grown in the Punjab, in the size of its grain,

* Species *Fagopyrum esculentum* and *F. polygonum*.

being very much larger: a sample of gram from Dera Ismail Khán was remarkable for the small size of its grain; and a peculiar description of this pulse was exhibited from Muzaffargarh resembling the Kábuli gram more than any other, but redder in its tint. A sample of black and red mixed was sent in from Kúlú. A bluish-black sample was shown from Peshawur—one sample of bhút (*Soja hispida*) was exhibited from Simla: some curious vetches called locally *sradma*, or *sranma*, from Zangkskár and Spiti, were exhibited, but they could not be botanically identified, though apparently the same as the "mattar rewari" from Amritsar, "karain" from Gujrát, and "mathar" from Kangra.

GRASS SEEDS.

The grass seeds used as human food were but few in number, and those only appeared to be used in times of famine and general scarcity; but there are some which perhaps are worthy of notice, among this is the phog (*Calligonum polygonum*), from Sirsa, the seed of which is used in times of famine, for human food. Dháman or anjan (*Pennisetum cenchroides*) is considered the best grass for cattle, rapidly improving their condition and increasing their produce in milk. Jhang exhibited a scented grass (probably *Andropogan schœnanthus*); a similar specimen was also sent from Muzaffargarh. Muzaffargarh sent also a grass called kawi (*Andropogan muricatum*), the root of which forms the khas khas used in matting tatties and screens for cooling purposes.

The Lahore collection contained a large series of grasses procured from the grazing grounds and jungles of the district: the collection contained over 30 varieties, and consisted of all those that could be procured at the season of the year. Their use is principally as fodder, though some are strong enough as rope materials, and are also used for thatching. The dib grass (*Cynodon dactylum*), is the common grass collected by syces for feeding horses, and there is one species, the "markan" grass, the fruit of which was eaten long ago during a famine, the year of which is still remembered by the title "Markanwalí Sál." It is remarkable to observe how the natives distinguish the many kinds of grasses by separate names, showing the original pastural habit of a portion of the population.

Methi or fenugreek (*Trigonella fœnugrecum*), was exhibited from Lahore, Shahpúr, Simla, Gujranwalla, and Gugaira, and there were a few specimens of pálak (*Spinachia oleracea*), and one of "lúnak," also used as a green vegetable (*Portulacca oleracea*).

HOPS.

Three samples of hops were exhibited, one from Hazara, one from Kasaulí, and one from Simla: the sample from Simla was decidedly the best, and was of remarkably good quality, the others appearing to be old and inferior, or to have suffered very much from the packing.

JURY AWARDS.

The Jury stated the collections for which they considered prizes should be awarded as follows:—

SIRSA.—The Jury recommended a silver medal to be awarded, for the general excellence of the collection, for completeness of information supplied with the specimens, and for individual excellence of certain samples, *e. g.*, Peshawri rice, introduced into the district by MR. OLIVER, dáúd kháni wheat, and ghoni wheat.

KANGRA was recommended for a certificate for the general excellence and size of its grains: the grains from Spiti were particularly interesting; the wheats, barleys, and rices attracted considerable attention.

HUSHYARPUR was recommended for a certificate for general excellence of articles, for completeness and interest of collection, and for the fullness of information supplied with the various articles.

LAHORE was recommended for a certificate for the extent, completeness, and general excellence of collection, as well as for the interest and individual good quality of many of its samples, particularly the wheat and barley.

GUJRAT was recommended for a certificate for the general excellence of its collection.

MUZAFFARGARH was recommended for a certificate for the great excellence of the samples individually, and for the interest attaching to the collection.

SIMLA was recommended for a prize of five shares, or 50 rupees in value for its hops.

The Jury considered the following collections worthy of honorable mention:—

AMRITSAR.—This collection was very extensive, and many of the samples of great interest, but it is to be regretted that when they came before the Jury, many of the articles were so worm eaten and dirty, as to render appreciation difficult.

SEALKOT.—The rice in this collection was worthy of notice.

GUGAIRA.—The Gilgit wheat and paighambri barley (black) in this collection, were considered worthy of mention.

DERA GHAZI KHAN.—The wheat from this district was considered of remarkably good character, and entitling the collection to notice.

After thus reviewing in detail the note-worthy samples in the collection, the Jury conclude their Report by offering some general suggestions and observations relative to the state of Agriculture in the Province, as far as that is illustrated by the collection before them.

The grains exhibited can only be judged of as samples according to the appearance, nutritiousness, or other qualities: they furnish no information as to any system of agriculture pursued in their production; the Jury therefore on looking at a sample of wheat, could not take into consideration the method of its production, nor how it was cultivated, whether on such principles as are generally correct, or whether on such as are calculated to exhaust the land and to debase the crop, both in quantity and quality. They are consequently unable to report or suggest with reference to methods of ploughing, sowing, weeding, hoeing, irrigation, rotation of crops, manuring, and the like; but on seeing the *varieties* of grain that are capable of being produced, and the excellency of some of them, they infer that the Province is capable of producing in the different classes of cereals, pulses, and millets, crops of a much improved character, to those now grown and in much greater quantity. They offer the following suggestions on this point. The greatest difficulty no doubt to be met at starting is the indolence of a portion of the agricultural class, and that contentedness with the existing state of things, and that lack of desire for progress and improvement which characterise alike the indolent and the industrious classes of agriculturists. To overcome these obstacles is no doubt difficult, but in order to do so, we are in possession of a great stimulus which operates to overcome both. The love of gain is predominant, and if we can succeed in practically demonstrating, that improved principles combined with painstaking effort, result in a large increase of profit, we shall not fail in our object: there is no impossiblity in changing the leopard's spots in this instance, it is within every one's memory, how many of the tribes on our frontier—Afrídís, Wazírís, and others, whose previous occupation was rapine and plunder, have since the inauguration of our rule, as the Board of

Administration remarked in their first report, sold their horses and bought oxen, and taken to agriculture with zeal. The Rajpút has an inveterate contempt of the plough, yet multitudes indolent as they are, have been forced of sheer necessity to till, or die. The tea cultivation in the Kohistán has given employment to many more; in fact we need not despair of any class.

The Jury are of opinion that improvement might be effected especially by the following means :—

1. By the frequent holding of agricultural exhibitions, either general or of districts, or both, at which rewards should be given for products of novelty or excellence. Such rewards have been already offered in connection with the cultivation of flax at Sealkot, and with the happiest results. The Jury are of opinion that the extension of these rewards to other branches of agriculture, such as indigo, sugar-cane, wheat, cotton, pulses, &c., would be highly desirable.

2. The Jury are of opinion that a great deal might be done, by distribution of improved varieties of seed of all kinds of crops susceptible of amelioration. The improvement of seed stock is a point which has hitherto received little or no attention. Considerable success has already attended the distribution of cotton seed of approved growth, though the experiments have been on a very small scale; the same might result in the case of corns, pulses, &c, especially if done on a larger scale. An attempt has recently been made by the introduction of the Pedigree wheat of England, illustrated descriptions of which have been printed and circulated in the vernacular, but there is no reason why great improvement should not be effected by interchange of seeds within the Districts of the Province, *e. g.*, the beautiful wheats of Rawalpindi district, the Gilgit wheat, and various fine varieties of large grained white wheat, which occur in some Districts, might be advantageously sent for trial in others.

3. The formation of an experimental farm by Government, superintended by a person whose sole duty was to attend to it, who would introduce improvements, carry them out, and send forth instructed laborers once employed for pay on the farm, to cultivate on their own behalf, and practice what they have learnt, and thus exhibit by actual results to the surrounding Zemindars, the value of the plans advocated, would go far to spread abroad an improved system. At home where there are large capitalists, who like Mr. Mechi and others, expend large sums in experiments of this kind for the good of the country, such schemes are taken up and worked by private individuals—here we have no capitalists of this class,* so Government must take it up, if it is to be done at all, and there can be no doubt that they would have little reason to regret the step. The farm would soon be more than self-supporting.

The establishment of small model farms would not succeed, they would never be under a uniform system of management. District Officers come and go, and there would be a perpetual fluctuation : one would take an interest, the next might not, and the model farm would be a model, which instead of promoting, would hinder the spread of any improvements.

The Jury do not think that much good would result from an attempt to force indiscriminately all kinds of English husbandry tools on native farmers : the native plough has

* Subsequent events have tended in some measure to invalidate this statement ; but it may be allowed to stand until time shall show the result of the scheme for a large agricultural company now under discussion. If these results are successful, it will be a pleasing task to expunge this paragraph from the text.—B. P.

been much cavilled at, but after all it is very well suited for the soil in which it has to work, and there is great doubt whether the introduction of an English plough with its deep furrowing power, and its costliness (as compared to those now in use), would be of any material benefit.

The most important points to start with would be teaching the principles of a good rotation of crops and of a good system of manuring (both these points could be ascertained and tested in an Experimental Farm).

Last, but not least, is to be noted the importance of giving good seed, and teaching the people the principles on which to select their seed, and promoting an easy interchange of approved varieties from one district to another. There can be no doubt that if these points alone were attended to, the productiveness of many districts might be largely increased. And when we recollect that now regular Settlements exist in almost every district, and that the farmers are thus assured that within the long term of years fixed in the settlement contract, nothing can augment the Government claim, and that therefore all extra profits, resulting from their own skill, industry, and improvement, are secured to them beyond the power of a doubt,—when he sees too year by year that roads are being made, renewed, or extended, thus facilitating more and more the transport of grain, &c., to the central markets, he cannot fail to perceive that eventually success must crown intelligent effort. The obstacles as before intimated are great, very great; we must not under-estimate them, or we shall be sure to be disappointed—but at the same time we must not give over our endeavours on their account, or deem the difficulty insurmountable. The progress of the hard-working, rough, unintelligent and prejudiced "Jat" from his present state, to that of a thriving and intelligent farmer, is scarcely more visionary to contemplate, than the transition which history has marked in the past, and our senses verified in the present, the transition from the painted savages of Britain in times of the Druids, or the scarcely more civilized churl of Anglo-Saxon days, to the rich and ever progressing agriculturist of the nineteenth century. It is remarkable that at no period of the history of India has more effort or enquiry been directed than at present, to the extention of trade and to the facilitation of the production of articles of commercial value: iron, flax, coal, indigo, hemp, and many other products have all been (and deservedly) the subject of surveys, experiments, and reports; and the advance of agricultural knowledge should also be urged upon those who are the prime movers and directors of such inquiries and efforts. We cannot but point to the fact that agriculture is the sole occupation of two-thirds of the population, if not more, and that no surer way could be found to promote the physical welfare of the masses, than improving or encouraging that art from which they immediately derive all their substance.

A. M. DALLAS,

Reporter.

SUB-CLASS (B). PRODUCTS OF THE GROUND, OTHER THAN GRAINS, WHICH ARE USED FOR FOOD.

The establishment of this sub-division is rendered necessary by the fact that many roots, seed vessels, and fruits of trees are used by the natives of various districts as food,—which are in themselves plants of considerable botanical and economic interest, and which are not strictly speaking agricultural products in the sense in which that term is ordinarily used.

Several of these articles, though edible, are by no means of general consumption; they have been discovered probably, and used in some season of scarcity, and have retained their place in the class of foods because they are available if necessary, when such seasons occur. A number of them are the produce of the Rukhs and Thal tracts of barren districts, where, owing to the scantiness of agricultural produce, the poorer classes are glad to eke out their slender sustenance with such means as these, which are for the most part produced without aid or expense on the part of man.

This class includes food-substances under the following heads:—

1. Mushrooms.
2. Roots, eaten either dried or boiled as vegetables.
3. Starch-yielding roots or seeds, eaten when reduced to powder—as arrowroot, salip, singhárá.
4. Seed vessels, fruits and berries, including Cucurbitaceous fruits, fresh and dry.

MUSHROOMS.

893.—[4041]. Mushrooms *(Agaricus campestris)*, "samárák" or samárúgh, from Kábul. Local Committee, Peshawur.

The price, is 2 seers 12 chitacks per rupee. The Pashtú name is said to be "kharaira."

Mushrooms are common in many places. At Lahore during the rainy season, they are abundant: they can also be artificially cultivated. The best works on Gardening contain full particulars, so it is not necessary to detail the process in this place: some good papers on the subject will be found in the Pamphlet containing the Proceedings of the Agri.-Hor. Society of the Punjab, from August to December, 1865, pages 10-17.

There appear to be three kinds of edible fungi in the Punjab.

1. The mushroom (*Agaricus campestris.*)
2. The morel (*Morchella esculenta, Phallus esculentus*).
3. Truffle (*Tuber cibarium*), or allied species, "khúmba," "khumbúr."

The mushroom is usually called "pad bahera," and the morel, "guchi," or "kánú gachú."

Dr. Henderson mentions that in Shahpúr and other districts, where there is "kalr" in the soil, both morels and mushrooms are abundant, the former in August and September, the latter in the end of the cold season, after heavy falls of rain. The same observer states, that he has seen morels half a pound in weight, and mushrooms half a foot in diameter.

Mussulmans eat only the morel, and consider the mushroom as "harám" or unlawful food.

Natives say that every mushroom having a pleasant smell and taste is wholesome.

In the Jhang district, an underground morel, called "phaphor," is found in fields of jawár (*Holcus sorghum*); and Edgeworth, in the "Florula Mallica," mentions an esculent morel, which he calls "banphal."

Dr. Henderson says—"The encamping grounds are the favorite situation for both morels and agaricus, and on one occasion I found an extraordinary crop, where an old kutcha building had been thrown down; it appeared to me that wherever a piece of old lime or plaster of the wall had fallen and been covered by rubbish, there a crop of mushrooms sprung up."

It is said that the morel and agaricus have both narcotic effects when eaten. Quantities of morels are brought from Kashmír to Amritsar.

894.—[3661]. Mushroom (*Agaricus*

sp——?) khúmba, khambúr. Muzaffargarh. Local Committee.

This is a species of a pure white color, with a powdery surface and destitute of gills; it is very common in the rains, and is much esteemed as an article of food. Fried in the ordinary way they are equal in flavor to English mushrooms. They are called khúmba, and when very large khambúr. Although usually eaten fresh, they are also dried for future consumption: they preserve their flavor even in their dry state wonderfully well.*

895.—[3550]. Gúchiyan, Kashmír. H. H. the Maharajah.

896 —[ ]. Morels (*Morchella esculenta*). Called also "káná kachú."

They are imported into India from Kashmír (Royle, Himálayan Botany, 440).

Gharikán, a species of Polyporus, is used in medicine.

Lieutenant Lowther, in his Notes on the Products of Kashmír,† writes—"I saw fungi of all sizes and hues daily collected and devoured by old women, which in Europe would have entailed death to the eater. Either the soil of this favored valley, or the stomachs of these hungry beldames, must be of an uncommon order. On the green slopes which are constantly grazed on by sheep and horned cattle, I gathered quantities of superior mushrooms, and observed numerous champillons (a French dainty) in the thickets on the hills. Morels or truffles are produced, which are dried and sold in the chief markets." The writer goes on to mention a morel, which sells at 2 annas per seer, and is called "*kungutch*" (kaná kachú ?): it imparts a rich mushroom like flavor to soups, gravies, &c.

897.—[ ]. Truffles (*Tuber Sp*——?) Kangra hills.

These were first found by Mr. G. Taylor. I am indebted to the letter communicated by Colonel Elphinstone to the A. H. Society, for the following particulars relating to them:—"The truffle is described as a round rootless tuber, which when peeled and cut, displayed the anastomosing veins and granular formation of the true truffle: they were mostly growing at a depth of a few inches under the soil, while some of the larger ones had made their appearance above the surface. The locality was a rocky tongue between two shallow hill streams, and the formation appeared to be sandstone thickly overgrown with pines (*P. longifolia*), though the immediate spot where the truffles grew was free from underwood, and only shaded by a few larger trees of the same species. One or two natives recognised the substance and said they had eaten it: others did not know of it. The truffle is brown or black inside; on eating it, it was found highly flavored, and of excellent quality."

This is not the same as the common truffle of France (*Tuber cibarium*), which has a very rough and uneven surface, and is of a dirty black color: nor is it the *Tuber albidum*, or white skinned truffle. Both these species have a thin skin which differs but little in color from the inside. The truffle of the Kangra valley on the contrary has a thick skin, differing in color from the inside, and a smooth surface. It is of an earthy yellow color, not unlike a potato in appearance, and when cut through shows different gradations of color, from white to black, according to its age.

It more nearly resembles the Piedmontese truffle (*Tuber magnatum*), and is of large size, a diameter of four inches being by no means uncommon.

It said that in Europe truffles are never found in coniferous forests, and only in calcareous soils: it is remarkable that as far as we know the Kangra truffle is found *only* in "chír" forests.

Truffles can be preserved as follows:—

After being peeled and washed, they should be placed in a large mouthed bottle, half a teaspoonful of salt and a little water be put over them, and then tightly corked. The bottle should be placed in boiling water and allowed to boil for half an hour. When cold, the cork should be well covered with sealing wax, so as to exclude air.

EDIBLE TUBERS.

898.—[3190]. Potatoes (álú), from Gujranwalla. Local Committee.

899.—[3972]. Potatoes. Hazara and Dungagalli. Deputy Commissioner.

900.—[ ]. 'Arbi (*Arum colocasia*, L.; *Colocasia antiquorum*, Schott.; *A. ægyptiacum*, Rumph). Synonyms—Ghuyáñ, ghwíyáñ, kachálú.

Specimens sent from Simla—Kumharseñ (2724)* and Bagal (ghwiya); (2744); Kashmír, Jammú (kachálú) 3551; Dera Ghází Khán (kachálú) 3421; Shahpúr (Khúsháb) 3272 (arwi).

* Memo. on the Products of Muzaffargarh, by W. Coldstream, Journal Agri.-Hor. Society India, xiii., p. 2.

† Journal of the A. H. Society of India, Vol. viii., p. 207.

* The Hill specimens, Nos. 2724-44, may be Royle's *C. Himalensis* (*See* Royle's "Himálayan Botany," p. 405).

This plant is familiar to most readers: the large bright green arrow-shaped leaves are conspicuous in the fields in the rainy season: the root when fried is not bad, though very inferior to a potato. The use of this plant has been known for ages; it is mentioned by HERODOTUS and THEOPHRASTUS, whence its name *C. antiquorum*.

901.—[ ]. Zamín khand (*Dioscorea bulbifera*, L.)

The "yam" is a well known vegetable, and ranks next to the potato.

I have placed *Dioscorea bulbifera* provisionally opposite zamin khand, because the descriptions exactly tally. Zamín khand is in form a Sarmentaceous plant, having a large round root bigger than a turnip, and sometimes of such a size as to weigh 3 or 4 seers.

The root is a very dark purple color; rough, being covered with the little indentations, whence the stems of the plant spring up. When the root is cut open it is yellowish inside; at first it is very bitter and requires to be boiled several times, and sometimes also with lime water, before it is fit to be eaten. It is used also as a pickle. For this purpose it is cut into little pieces, and fried in oil till it becomes of a red color, and then it is put in vinegar, &c.; or in the mixture of mustard seeds ground up with salt, &c., in water or oil, which is sometimes used as a preservator. A sample of the pickle was exhibited in the Lahore collection.

Many species of *Dioscorea* are edible, the roots of some are used powdered as an application to ulcers; the flowers are edible. *D. globosa* is cultivated as the best species.

Simla, Bágal (2745); Kashmír (3549); Hushyarpúr (3967).

902.—[3353]. "Tarar," from Srínagar, Kashmír. H. H. THE MAHARAJA.

This is the root of the *Dioscorea deltoides*.

The natives of the Jammú hills assert this root to be the wild kachálú grown old, for the young plants have not root enough to be of service, but when the plant is old the root grows large. STEWART, in his Notes of a Tour in the Khághán valley (p. 52) gives the local name as *kriss*, and says that it is used for washing silk.

903.—[2574]. Batata, "shakarkand" (*Convolvulus batatas*, L.; *Batatas edulis*, Choisy; *Convolvulus esculentus*, Spreng.), from Palwal Gurgaon. DEPUTY COMMISSIONER.

This is a highly nutritious root; the tender shoots of the plant are eaten also. The leaves make excellent fodder for cattle; the root is said to have a slightly laxative effect.

904.—[2732]. "Bach" (*Acorus calamus*, L.) Simla, Kumharseń.

The root is eaten boiled. A number of species of Cyperus yield a fecula which is good as a diet. *C. bulbosus*, *C. esculentus*, and others; and *Scirpus tuberosus* in China.

The name bach is given to *Acorus calamus aromaticus*, which is used medicinally as a stomachic, aromatic and stimulant. In Constantinople a sweetmeat is made out of this root. The leaves are also fragrant, and the plant is exported to Europe, where a hair powder is made of the roots, the scent being supplied by the leaves.*

I think it very questionable whether this "bach" is the *Acorus calamus*: there is an edible species of *Scirpus* described by ROXBURGH as *Sc. kysur* (Fl. Indica, Vol. i., p. 230), which may yield this root.

DR. ROYLE mentions that he has seen *A. calamus* in the Himálayas, and that it is used with the beans or seeds called "kat karanjwa" (*Guillandia Bonducella*) as a cure for ague.

905.—[3971]. Chamúna (*Cyperus bulbosus*, Vahl.)? Peshawur. LOCAL COMMITTEE.

Imported from Kábul; a sample was sent from Hazara.

This is called *Cyperus tuberosus* by the District Committee. In appearance it is a small bulbous nut-like root, with three blunt excrescenses on the surface. The skin of the nut or root is dark colored, is easily removed with the nail, or when dry it cracks and comes off of itself, and the inside is whitish colored. It is roasted and eaten. The sample consists of the little bulbs picked off the fibrous root to which they are attached.

ROXBURGH describes a Cyperus, of which the little bulbs are picked off and washed, and then rubbed gently in a cloth to remove the sheath, after which they are ground into flour. He states that the bulb has the taste of a roast potato. This exactly answers to chamúna which is probably *C. bulbosus*, Vahl. It is only known at Peshawur, and comes from Kábul.

The rhizomes of *A. cal. aromaticus* have been given successfully as a tonic in cases of intermittent fever. The roots of *C. hexastychus* are sold by druggists in the bazar, by the name of "magar motha."

906.—[2722]. Onions (*Allium cepa*). Synonyms—Piyáz gandhani (Punj.); basl (Arab.)

* "DRURY'S Useful Plants of India."

Simla, Bhaji (2722); Gugaira (3327).

This vegetable is eaten raw or cooked.

907.—[ ]. Garlic (*Allium sativum*). Synonyms—Lasam ; som (Arab.)

Simla, Bhaji (2723) ; Pattiala, Gugaira (3328).

This vegetable is always cooked.

908.—[ ]. "Surâl" (*Pueraria tuberosa*).

Mentioned by DR. CLEGHORN as one of the plants of Kúlú and Kangra. The tubers are exported to the plains.

909.—[ ]. Roots of "piperi" (*Tulipa stellata*).

Grows in the Sutlej valley, at an elevation of 4000 to 6000 feet : the root is edible (CLEGHORN).

910.—[2818]. Bulbs of "mungoh." Himâlayas. MR. GEO. JEPHSON of Simla.

This is described as a climbing plant, growing 20 to 30 feet high.

911.—[2819]. Bulbs of "godhí." (*Marsilea quadrifolia*, L.?) MR. GEORGE JEPHSON.

These are eaten either raw or boiled in the hills.

912.—[3548]. "Bekh-i-nílofar." (*Nymphæa edulis*, De. C.) Sríuagar, Kashmír. H. H. THE MAHARAJAH.

This is the root of the edible lotus, which grows so abundantly in the lakes of Kashmir (*vide* "kaul doda," &c., "tukhmí nilofar").

The collection did not include those we regard as fresh vegetables. Those most in use among natives are—

Gájar, carrot (*Daucus carota*.

Shalgham, turnip (*Brassica rapa*).

Múlí, radish (*Raphanus sativus*, L.)

Bhindi or tori (*Hibiscus esculentus*, *Abelmoschus esculentus*, W. and A.)

Múgra (*Raphanus caudatus*). This curious plant, with its enormously elongated seed-pods, has excited much attention in Europe, and the seeds sell at a high price : here seed can be easily had for Rs. 2 a seer. The natives have an idea that this plant is only the *R. sativus*, subjected to a peculiar treatment, viz., being taken up, and having all its roots cut close round and then replanted.

Onions,* piyáz—gandha (Panjabí) (*Allium cepa*), often eaten raw.

Garlic; lahsan or shom (*A. sativum*), is eaten always cooked.

Beans, "Sem" (pods of *Canavalia gladiata*, De. C.)

There are various plants used as greens, such as—

Methi (*Trigonella fœnugrecum*).

Pálak (*Beta bengalensis*).

Khúrfa (*Portulacca sativa*, L.) ; and lúnak or lúnyáñ (*P. oleracea*).

The leaves of chaulai and báthú, species of amar-Kashanths.

Soyá (*Anethum sowa*).

"Karm" a kind of greens (*Brassica*), used by míris and others.

Various other roots that are used are mentioned in the sequel ; also the Cucurbitaceus plants.

Vegetables are usually boiled, and the water squeezed out, after which ghí or oil, red pepper, or other spices and salt is added. Such vegetables as cabbages, calliflowers, lettuce, beet-root, celery, &c., are mostly used by Europeans ; a few natives eat green peas with pepper and ghi.

ROOTS YIELDING FECULA.

913.—[3966]. Arrowroot (*Maranta arundinacea*), Jálandhar. MR. TAYLOR.

914.—[ ] A sample of arrowroot, with a sample of the tubers from which it is obtained, exhibited by DR. JAMESON, Dera Dhún.

This plant appears to flourish in great differences of climate, having been grown at Madras and also successfully in the Dera Dhún and Jálandhar. The West Indian arrowroot is obtained from this species, and also from *M. nobilis*, and another ; ROYLE adds the *Canna glauca* (*Tous les mois*) as a source of arrowroot ; it is from the stems of a species of Maranta, that the material for making the much admired mats of Calcutta is obtained. DR. JAMESON writes of the arrowroot as follows* :—" It grows well throughout the N. W. Provinces. The tubers are ready in January, which is the best month for preparing the powder. It is thus prepared :—Wash carefully the tuber, and then reduce it to powder on a grater, wash it carefully and strain it through a cloth, by mixing it with water. This must be done at least four times, to extract the poisonous principle."

* DR. STEWART in his account of the Food of the Inhabitants of Bijnour, says that some castes of Hindús will not touch onions, garlic, turnip or carrots, from a supposed resemblance in substance to flesh : I am not aware whether such a practice obtains in the Punjab.

* Report on the Botanical Gardens, Saharanpore, p. 3.

915.—[ ]. Sálab misri (*Orchis mascula*, L.; *Eulophia vera*, Royle; *Satyrium?*)

916.—[3970]. Salep, from Kábul. Peshawur Local Committee.

Selling price, Rs. 8 a seer.

Dr. Cleghorn writing from the valley of the Chándrabhágá (Chenab), says of the plant as follows:—"Salep is believed to be the produce of several Terrestrial Orchids, belonging to the genera Orchis and Satyrium. The starch is highly nutritious, and the tubers fetch a high price. The commercial route is not exactly known by which they are brought to the plains, but as Kábul horse-dealers carry the genuine salep as far south as Bangalore, we may infer that Afghanistán is the native country. The producing plants occur both in the Himálayas and Nilgherry hills. Old residents at Simla and Ootacamund collect the tubers of various ground orchids which they use in their families as salep."

Dr. Bellew, of the Guides Corps, speaking of his journey to Kandahár, says that at Hazrah, four marches west of the Karram fort, at an elevation of 11,000 feet, he met with a species of Orchis. The following is extracted from his letter to Government, published in Mr. Davies' Report on the Trade and Resources of the Countries on the N. W. Frontier.

"The leaves of this orchis are thick and fibrous and contain a good deal of water, its root is a firm roundish tuber, from the size of an almond to that of a walnut. I believe it is the true salep. I have often examined samples of the salep exposed for sale in the bazars, and always found them to contain the roots of three or four different plants. These I could not positively recognize, but conjectured them to be the dried roots of the wild squill, the wild leek, and onion, and of the long thin leaved and other kinds of orchis plants, all of which I have seen growing in the same localities as the true salep-yielding orchis."

Lindley says that the salep of India is produced from a species of Eulophia,* and adds that several Orchids and Ophreous plants yield a similar product.†

The salep contains a principle, called by chemists bassorin, which exists abundantly in Tragacanth and in the Bassora gum of commerce.

The plant is described thus:—"The root consists of two bulbs, attached at the base of the stems (it is figured in Lindley's Vegetable Kingdom, p. 180). The stem is round, smooth, upright, and about a foot high; naked above but below surrounded with leaves, which are lanceolate, alternate and broadish; the flowers are numerous and on a loose spike."

* Royle says (Botany of the Himálayas, 28), that it is found in the hills between Jammú and Kashmir; that specimens of the plant with the root, leaves, and seed vessel, but without flower, were sent to Dr. Lindley, who considered it a species of Eulophia, and that he (Royle) has called it *Eulophia vera*.

† Veg. Kingdom, p. 180.

The principle value of the plant consists in its nutritious properties; it is eaten boiled with milk like arrowroot, and is much recommended as a diet in dysentry and internal inflammation. According to the doctrine of resemblances, judging from the form of the root, the ancients—Pliny, Galen, and others—supposed that the roots had great restorative and aphrodisiac powers. Honigberger* says, that the natives attribute different virtues to the different sorts, and mentions in his list of localities producing salep, Hindústán. Beside the two varieties, salep "misri" and "kohi," he failed to discover others; but a variety is undoubtedly sold under the name "Hindustáni" (see note on next page). Salep is produced in the Nilghiris, and there are salep yielding species in Ceylon.

MacCulloch and others, speak of the salep as if it were an artificial substance made up into little lumps; but all the salep I have seen consists of the pale brown, semi-translucent roots themselves—of various sizes—from quite small, hardly bigger than an almond, to the size of a dry fig. The roots are strung on a string like beads, and so brought from Kábul and other places where they grow; hence the roots bought in the bazar are generally found to be pierced. Ainslie mentions that saleb possesses the curious property of depriving sea water of its salt taste, a property which, he remarks, might be turned to account in long voyages. The mucilage of salep answers best for this purpose.† Saleb is said to contain the greatest possible quantity of nutriment in the smallest space. About 60 parts of boiling water are required to one of salep to dissolve it.

As to the locality of this plant, there can be no doubt that it is produced in the hills of Biluchistán, Kábul and Bukhára, whence it is brought into India. In Appendix XIII. to Mr. Davies' Report, Mashad is mentioned as a locality producing annually one maund of salep, at value of Rs. 4-8 per seer, which comes *viâ* the Bolan pass to Shikárpúr, and then to the Punjab; it is the Egyptian *(misri)* salep coming from Cairo and Arabia, through Persia, which reaches Mashad and Herat, and is thence imported in small quantities to India.

The author of the Makhsan-ul-adwiya says, that it grows in all marshes and hills everywhere, but the two best kinds are "rúmi" and "misri." The "rúmi,"

* Thirty-five Years in the East, p. 339.

† Mat. Med. Ind., I., 369.

or Turkish, is the best, because it is allowed to ripen in the ground, while the "misri" is picked sooner.

It is also produced in the hills between Kashmír and Jammú, and that of the best quality. The Pansáris uniformly assert that the real "misri," or Egyptian salep, is not found anywhere here but is imported from Egypt and Arabia. DR. ROYLE mentions (page 371, Himálayan Botany) that gardeners from the Saharunpúr garden were sent with the traders into the Hills, and they found salep a little way beyond the Jihlam river, at the place where the road from Kashmir to India crosses it. These specimens were said by DR. LINDLEY to be an Eulophia, and ROYLE has called the species provisionally *E. vera*. DR. ROYLE says that he actually tried and succeeded in obtaining good saleb from *E. campestris*, gathered near the Kheri pass. (The root is preserved by boiling for a short time, and then drying carefully). LIEUT. HUTTON, in an account of a visit to the Broang pass, says that "even the grassy hills between Phuggoo and Mullianáh, during the rains, immense quantities of a species of orchis were collected as a salep misri, which were dried and sent to Simla, whence they were sent for sale in the plains."

A species, probably says ROYLE, *Eulophia herbacea*, is used for salep at Masúrí. Salep misri is said to be found in Hazara but only on the higher hills, but this is really a root, called "karimcha," "mithúwa" and "núr-i-'álam," which sells for about 5 annas a tolah. I have found this plant, which is a species of *Convallaria*, having red berries, and is very like the well known "Solomon Seals" of English gardens. In the district list of the Hazara contributions, salep misri and shakákul are written as synonyms.

From these facts we may safely infer that the saleb of the bazars consists of the roots of more than one species; that the best, or saleb misri, is that which is the genuine or standard saleb of Kashmir, and the other, saleb kuhí and Kábulí, such species as are brought from Kábul, Simla and other hill places, while the smallest and worst is found in parts of the Punjab and Hindústán, called salep Hindustáni.* In Europe several orchids yield salep, *Orchis papilionacea*, is called in modern Greek "salepí." The other salep yielding European species are *O. morio*, *O. mascula*, *O. militaris*, *O. latifolia*, and *O. bifolia*.

917.—[3422]. "Borí." Dera Ghází Khán. LOCAL COMMITTEE.

This is a curious substance in yellow lumps, consisting of the pollen of the dib grass (*Typha elephantina*), collected and kneeded together, perhaps with the aid of a little molasses.

918.—Singhárá, water caltrop (*Trapa bispinosa*).

Though not a root, it is a substance so nearly allied in its qualities and uses to arrowroot, &c., that it is included.

A fine series exhibiting the use of this plant was sent, comprising—

(*a*.) The plant with the root.

(*b*.) The brown horny fruits with the long spines, whence the name *bispinosa*.

(*c*.) The nuts or fruit containing the fecula, with the shell removed.

(*d*.) Fine flour of the singhárá.

(*e*.) Fine colored pink flour, used by Hindús to throw at one another in the Hólí festival.

The singhárá is planted in the month of June, and is ripe in November, the deeper the water the better the crop. Green singhárá sells at 1 maund 24 seers per rupee, and dry at 18 seers per rupee. Singhárá flour sells at 8 and 10 seers per rupee: it is much used at Hindú festivals, and is also colored and thrown about during the Hólí. The produce of one seer of seed in a good season is about 20 maunds. Specimens were sent from—

Muzaffargarh (3968).

Lahore (3643).

Singhárá "purbiya," Amritsar. (The down-country (*purb*) singhárá is superior).

Singhárá desi (3036). Amritsar.

Jálandhar (3574). The Jálandhar Committee remark that the singhárá grown in the pools near the Jálandhar Cantonment is considered very superior.

919.—[3531]. "Maghz" (or kernel of the) singhárá. Jammú. H. H. THE MAHARAJA OF KASHMIR.

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* In the bazars of Lahore city, three varieties were obtained. One the largest, about 1¾ inch long and 1¼ inch broad, in shape flattened, ovoid, coming to a point; this is called "saleb misri," and sells for 4 tolahs per rupee. This is stated not to be produced in Indian countries, but is imported, it does *not* come by sea, and probably comes from Persia and countries beyond. This specimen was laterally transfixed by a string, which once had held a number together.

The next kind is smaller, but otherwise similar. This is called "Kábúli," it is a little over an inch long and less than an inch wide, it tapers gradually to a point, having at the upper end an indentation where the stems springs: it sells at about 6 tolahs a rupee.

The third variety is called "Hindústani;" the smallest of all, being very narrow in proportion to its length. It is about an inch long and less then a quarter broad, and looks like the incisor tooth of an animal; it sells at 10 tolahs per rupee. It comes from Kanhuwán, in the Gurdaspúr district, near Batálá, and from several other places also.

Speaking of the singhárá, Dr. Royle writes*—" A species called by the same name, forms a considerable portion of the food of the inhabitants of Kashmír, as we learn from Mr. Forster that it yields the Government £12,000 a year of revenue; and Mr. Moorcroft mentions nearly the same sum as Ranjit Singh's share, from 96,000 to 128,000 ass-loads of this nut yielded by the lake of Ooller.

The following account of singhárá is extracted from Col. Sleeman's "Rambles of an Indian Officer."

The long stalks of the plants reach up to the surface of the water (in which they grow), and upon which float their green leaves, and their pure white flowers expand beautifully among them in the latter part of the afternoon.

The nut grows under water after the flowers decay, and is of a triangular shape, and covered with a tough brown integument adhering strongly to the kernel, which is white and esculent, and of a fine cartilaginous texture. They ripen in the latter end of the rainy season and are eatable till November.

In the N. W. Provinces, the cultivation of these is extensively carried on by the Dhámar casts, who keep boats for planting, weeding and tending this water crop. The holdings of each cultivator are marked out in the tank by bamboos. The rent paid for an ordinary tank is about Rs. 100 a year. But the plants cause such an increase of mud that a tank is quickly spoiled by these plants, and the cultivation is not allowed where the tank is required as a water reservoir for use as such.

SEEDS AND SEED VESSELS USED AS FOOD.

920.—Lotus fruits, "kaul doda" (*Nelumbium speciosum*, Willd.; *Nymphœa nelumbo*, L.; *Nelumbo nucifera*, Gœrtn).

Sent from Simla; Ambálah; Dera Ghází Khán (3669); Gugaira (3314).

This is supposed to be the bean of Pythagoras,† "bákla kubti:" not only the black seed or nut, but also the root and the flower are edible, as is the case also in several species of Nymphæa. Nelumbium is planted in tanks, says Royle, now in India, just as it was in Egypt, by enclosing a bean in a ball of clay and throwing it into the tank, &c. This is not to be wondered at if it be true that the Egyptian bean lotus was originally indigenous in India and found its way into Egypt; although several species of Nymphæa still are found in Egypt this species has entirely disappeared. It is accurately described by Herodotus as follows:—

"There are also other lilies, like roses, that grow in the river, the fruit of which is contained in a separate pod, that springs up from the root in form very like a wasp's nest: in this there are many berries fit to be eaten, of the size of an olive stone, and they are eaten both fresh and dried." It grew abundantly in all the lakes and canals. Strabo and particularly Theophrastus, have both mentioned the sacred plant of Egypt, and the latter has most minutely described it, but the *savans* who accompanied Napoleon in his expedition to that country looked in vain for it. It has long ago disappeared. The most remarkable part of the plant is the structure of the seed receptacle, which has been aptly compared to a pomegranate cut in half, or as Herodotus says, is like a wasp's nest. When ripe, the seeds are loose each in their separate cells, and if shaken make a noise like a rattle. Unlike the Nymphæa, the stems, petioles, and flower-stems of the lotus are raised above the water, a peculiarity which may serve to distinguish it, where so many errors have been made in the specification of the two genera. In this country, as well as in China and Ceylon, the flowers are held especially sacred.

921.—[3557]. Tukhm-i-nilofar. Sirsa. Deputy Commissioner.

These are the capsules and seeds of *Nymphœa edulis*, which are eaten or else mixed with flour and made into cakes; they are also *curried*. A sample of the edible root was sent from Kashmir, the stalk and flowers are used also as vegetables, or are dried and used as a cooling medicine.

922. Seeds vessels of the "jhand" (*Prosopis spicigera*, L.; *Adenanthera aculeata*, Roxb.)

Gugaira (3309).
Sirsa (2647).
Muzaffargarh (3658).
Lahore (3615).

These are called "sangri," or "shangar." The tree is abundant in the rukhs and desert tracts, where

* Himalayan Botany, 211.

† Whatever reason there may be for identifying the bean of Pythagoras with the seed of this lotus, in is evident that the poet Horace regarded Pythagoras' bean as the common garden bean; he speaks of it thus (Sat. II. 68):—

"O quando *faba Pythagoræ cognata* simulque,
Uncta satis pingui ponentur oluscula lardo."

Here the homely juxtaposition of beans, cabbage and bacon (familiar to the Augustine poet in his Sabine farm as in the England of to-day) excludes the notion that the bean of Pythagoras was the lotus seed: the argument is by no means conclusive, but the opinion of Horace indirectly expressed comes in curiously in discussing the question of identity.

† Drury's Useful Plants of India, p. 323.

it grows as a stunted knarled and crooked tree; its wood is hard, and both root and stem make excellent fuel. The seed vessel contains a farinaceous substance of a pleasant sweetish taste. The young pods are eaten green, and when ripe are preserved dry. MR. COLDSTREAM mentions that in Muzaffargarh it is eaten mixed with dahi (or curds) and called "craita," and that it is also boiled with ghí as a relish. Shángar is used by Hindús on the "bart" or fast days.

923.—[3659]. "Phogli" Muzaffargarh.

This was the only specimen exhibited. MR. COLDSTREAM writes of it:—"Found only in earth on the margin of desert tracts; the plant is called "phoke." It somewhat resembles the caper in its habit and color, being destitute of true leaves and composed of numerous fine and angular branchlets. It is much more slender then the caper, and does not attain to the same size. The flowers and fruit, which are very small and of a gray color, fall off on attaining to maturity, and are gathered by the natives, who make them into bread, or mixing them with ghí use them as a relish. The fruit is called phogli, and is well known throughout the district.*

924.—Sittú (*Boucerosia edulis*). Muzaffargarh.

MR. COLDSTREAM writes of this specimen:—"The sittú, called, I hear in the Jhang district "pippu," is a remarkable little plant of some value in these regions. It has been fully described and figured by EDGEWORTH in his "Florula Mallica," under the name of "Boucerosia edulis."

The root is a wide spreading rhizome, which runs irregularly under ground, among dense thickets of the jhand, jhal, or other shrub, and sends up numerous little stems from 6 to 12 inches high; mostly erect and bearing small sessile acuminate leaves. These shoots are very tender and succulent. They have a pleasant subacid taste, and are extensively used by the poorer classes during the rains to give a relish to their farinaceous diet. Sitú is occasionally, but not often, to be seen for sale in the bazar.

This was described by a native of Lahore as growing in karíl thickets, by the name of "súhi gandhal."

CUCURBITACEOUS VEGETABLES.

925.—[3305]. "Kakora." Gugaira. LOCAL COMMITTEE.

This is the *Momordicata muricata*, Willd.; it is cut into slies and dried, these are easily recognized by their being divided into four compartments with seeds in each; the skin is rough.

926.—[3306]. "Kachri" (*Cucumis pubescens*, Willd.) Kachri is also sent from Lahore (3914) and Amritsar.

The following Cucurbitaceous seeds are exhibited.

927.—[3671]. Pumpkin seeds (*Cucurbita maxima*). Peshawur. LOCAL COMMITTEE.

928.—[3672]. Melon seeds (*Cucurbita melo*).

929.—[3673]. "Sirda," melon seeds.

This celebrated fruit rapidly degenerates if sown in the plains. In Kábul it thrives and is in perfection in October and November, when the first frost touches the plant. It is brought for sale into the city of Peshawur largely.

930.—[3380]. Seeds of musk melon (*Cucurbita melo*).* DERA GHAZI KHAN.

931.—[3381]. Seeds of water melon, tarbúza (*Cucurbita citrullus*).

A number of melon, cucumber and "kadú" seeds, are included among oil seeds, on account of their yielding oil.

The consumption of Cucurbitaceous plants in the province is very considerable. In the proper season melons, cucumbers, &c., are to be found by thousands, in every bazar, and the natives eat them with delight in quantities. The crop is easy of cultivation: they require at first that the seed should be sown in a damp soil, but after that they require no irrigation for sometime till the trailing plant has attained a considerable size. The earth is then loosened about the roots, and afterwards irrigation is given. Manure is frequently given, and some species benefit by the application of alkaline earth to the roots.

The principal cultivated varieties are the bottle gourd, kaddu (*Lagenaria vulgaris*, Ser.), a very large gourd of this description dried, was among the collection. Fakirs make bottles out of this gourd, and the large ones (túmba) furnish the body of the "sitar," or guitar. There is also a wild species, which is entirely bitter and even poisonous. Besides there are the white kaddu, kaddu safed, or "squash" (*Cucucurbita pepo*, L.), and the karela (*Momordica charantia*), which is used as a pickle, and also as a vegetable.

DR. ROXBURGH writes of the white kaddu as fol-

* Journal A. H. Society India, Vol. xiii., p. 2.

lows:—"This appears to me to be by far the most useful species of *Cucumis* that I know; when little more than half-grown, the fruits are oblong and a little downy, in this state they are pickled; when ripe, they are about as large as an ostrich's egg, smooth and yellow; when cut they have much the flavor of the melon, and will keep for several months, if carefully gathered without being bruised and hung up: they are also in this state eaten raw, and much used in curries by the natives. The seeds like those of other Cucurbitaceous fruits, are nutritious; the natives dry and grind them into a meal, which they employ as an article of diet; they also express a bland oil from them, which they use in food and burn in their lamps. Experience as well as analogy, proves these seeds to be highly nourishing and well deserving of a more extensive culture than is bestowed on them at present. The powder of the toasted seeds mixed with sugar is said to be a powerful diuretic, and serviceable in promoting the passage of sand or gravel. * * * * * In the Guntoor Circar, where the seeds form a considerable article of commerce, they are mixed with those of *Holcus Sorghum* or some others of the large culmiferous tribe and sown together; these plants run on the surface of the earth and help to shade them from the sun, so that they mutually help each other. The fruit as I observed above, keeps well for several months if carefully gathered and suspended. This circumstance renders it an excellent article to carry to sea during long voyages.

932.—[ ]. Kakri (*Cucumis utilissimus*).

This is very extensively eaten by natives, who eat the whole, skin and all, raw. Europeans make a salad of it with vinegar, which is very like the cucumber, but has not so much flavor.

933.—Khírá, khiyár (*Cucumis sativus*).

The common cucumber.

934.—Tindá (*Cucurbita lobata?*)

A small round gourd when young, at which time it makes a most delicious vegetable for the table: the fruit is not bigger than a small turnip.

935.—Pethá (*Benincasa cerifera*).

This species is used principally in making a sweetmeat, which consists of pieces of this gourd coated with sugar; it is said to have cooling properties.

936.—Tori or turai (*Luffa acutangula*).

This is occasionally cultivated, and cooked as a vegetable or curried.

The species eaten as fruit are—

937.—Tarbúz, hindwána, water melon (*Cucurbita citrullus*).

The juice of this fruit is very cooling, and is said to do well for a cooling drink and antiseptic in typhus fever. Ainslie mentions (p. 217) that he has thus used it with success when he could not obtain oranges.

938.—Kharbúza, musk melon (*Cucurbita melo*).

The common sweet melon, is very inferior to the English melon.

A number of seeds and fruits are also eaten, which were not exhibited, as not being capable of preservation—such were:—

Baingan (*Solanum melongena*).

Bhindá torí (*Abelmoschus esculentus*, W. & A.; *Hibiscus esculentus*, L.)

The flower buds of the *Bauhinia variegata* (kachnár) are also eaten.

The seeds taken from the huge pods of *B. racemosa* are eaten in the hills. The pods look like pieces of thick undressed leather, about a foot long and an inch or two broad; they are placed over the ashes of a fire till they roast and split open; the flat soft seeds are taken out and eaten: the flavor is pleasant; but the seed is not wholesome.

It is said that the seeds of the palás (*Butea frondosa*), called pit pápra, are occasionally in time of scarcity, turned to account by being ground into flour.

SUB-CLASS (C). FRUITS, DRIED AND PRESERVED, AND PICKLES.

The fruits produced by this province are certainly not remarkable for their excellence. The best fruit, the mango, grows pretty generally; but really good kinds grown from grafts are only produced in a few of the best gardens; in certain districts, however, such as Hushyárpúr and Karnál, a fruit nearly equal to that of Bombay and Malda is produced. The majority of the common mangoes are small, often of a bright yellow and red color when ripe, and very stringy.

Mangoes are often dried before they are ripe, after having been cut in slices, called "ám chúr." The kernels are also occasionally eaten.

Of the other fruits, the guava grows freely in gardens; as does also a yellow bullace, álúcha *(Prunus domestica)*. Occasionally trees of the álú bukhárá *(Prunus bokhariensis)* are seen. Loquats are not uncommon. Peaches, both round peaches, and the flat Chinese peach, are abundant, but inferior in flavor, and somewhat dry in texture.

Strawberries have been introduced, and certainly are capable of being produced in considerable perfection. The cherry tree has been introduced, and there seems some hope of this fruit becoming naturalized in the plains.

Limes, citrons, and oranges of several varieties, are abundant during the cold season, and have a very beautiful appearance in the gardens. The plantains *(Musa paradisiaca)*, "khela" of this province, are larger than those of Bengal, and have much less flavor, but they make a pleasant dish when roasted or fried in slices.

Hardly to be accounted a fruit, is the acrid sloe-like jáman, the fruit of *Sizygium jambolanum*, which requires to be rubbed with a little salt before eating.

Carissa corundas produces the corunda, which serves as a tart fruit, and produces a palatable jelly.

The tipari, as it is called in Bengal, or Indian gooseberry (*Physalis peruviana*, W.), (Pers. 'Urusak dar parda, "Bride in the veil," from the fruit being enclosed within a loose covering), grows occasionally in gardens, and is tolerably good, especially when made into jam.

The "gondi" *(Cordia myxa)* is a yellow berry with a strong sweetish taste, and serves as a preserve fruit.

Grewia asiatica, fálsa, yields a berry which has a pleasant acid taste.

Long, thin, very sweet, but otherwise insipid mulberries of two colors, white and black, are produced from the trees of the shahtút *(Morus indica* and *nigra)*: this fruit is abundant in the beginning of the hot season.

The bér *(Zizyphus jujuba)* when cultivated yields the "'unáb," or jujube fruit. The wild shrub yields a smaller fruit or berry, which is eaten also, and called "kokan ber."

Perhaps the best fruits are those brought from Kábul, which are seen in abundance in the cold weather; they consist of raisins, dried apricots, sultana raisins (kishmish), walnuts, pomegranates (not very good ones), apples, pears, and best of all, very sweet green grapes, which are sent down in round boxes, each grape being picked separate, and packed between layers of cotton wool.

Currants (zirishk), both acid and sweet, the former being the fruit of the berberry dried and which resemble European currants, are also brought from Kábul and other hill places.

939.—The following series of fruits in model was exhibited from Lahore, by Tehsildar Barkat Ali Khan.

English Name.	Native Name.	Botanical Name.
Apple,	Seb, seo,	*Pyrus malus.*
Pear,	Naspátí, nák,	*Pyrus communis.*
Pomegranate,	Anár,	*Punica granata.*
Guava,	Amrúd, anjír,	*Psidium pyriferum* (white and red.)
Bullace plum,	Alucha,	*Prunus domestica.*
Bukhára plum,	Alu bukhára,	*Prunus Bokhariensis.*
Mango,	Am (maghzak, Ar.)	*Mangifera indica.*
Quince,	Bihi,	*Cydonia vulgaris.*
Mulberries,	Bedána,	*Morus indica.*
"	Shahtút,	*M. nigra.*
Jujubes,	Ber ('unáb),	*Zizyphus jujuba.*
Plantain,	Khela,	*Musa paradisiaca.*
Peach,	Aru,	*Amygdalus persica.*
Apricot,	Zardalú,	*Armeniaca vulgaris.*
Orange,	Náringí,	*Citrus aurantium.**
Citron, acid,	Khattá,	*Citrus medica.*
" sweet,	Mítha,	*Citrus medica*, var.
Lemon,	Nímbú,	*Citrus limonum.*
Thin skinned lemon,	Kághzi nímbú,	*Citrus acida*, Rox.
Lime,	Saugtarah,	*C. bergamotica*, Risso.
Galgal,	Galgal,	*Citrus galgala.*
Shaddock, pomello,	Chakotra,	*Citrus decumana.*
Jaman,	Jáman,	*Sizygium jambolanum.*
	Kamrak,	*Averrhœa carambola*, L.
Loquat,	Lukát,	*Mespilus japonica* (*Eriobotrya japonica*, Lind.)
Strawberry,	Istrábrí,	*Fragaria.*
	Amlok,	*Diospyrus lotus.*
	Lasúra,	*Cordia myxa.*
	Khirni,	*Mimusops kanki*, L.
Tamarind,	Imli,	*Tamarindus indica.*
Gondi,	Gondi,	*Cordia angustifolia.*
Falsa,	Fálsah,	*Grewia asiatica.*
Corunda,	Karunda,	*Carissa corundas.*
	Dilá,	*Capparis aphylla.*
	Pinjú,	*Salvadora oleoides.*
Date,	Khajúr,	*Phœnix silvestris.*
Bael,	Bel,	*Ægle marmelos.*
Emblic myrobalan,	Anwlá,	*Phyllanthus emblica.*
Figs,	Anjír,	*Ficus caricoides.*

Some of these will receive a separate notice.

The following fruits were exhibited of the nut kind.

940.—[ ]. Hijli bádám. Lahore. (Not common).

This is the cashew nut (*Anacardium occidentale.*) The pericarp of the nut contains a black acrid and poisonous oil. This oil is called cardole, and is a powerfully vesicating agent. It is applied to warts, corns, ulcers, &c., but it is said that the vapour of the oil when roasting will produce violent swelling and inflammation. A gum is obtained from the tree which is useful as a varnish, and is said to resist the attacks of insects. The kernel is edible and wholesome.

941.—[ ]. Walnuts, (*Juglans regia*) akhrot; or Chármaghz (Persian).

The species of this fruit is in every respect similar to those we see in Europe: they are sent from—Simla States—Bagal (3560), Sirmúr (3562), Basáhir (3565), Koti (3569), Balsan (3570), Baghal (3572); Kangra (Kúlú), 3575; Rawalpindi (Múrí hills) 3364; Peshawur (Kábul) 3681; Hazara, from Thandiani hills (3706); Kashmír, Srínagar (3710). The tree

* Dr. Royle says (Himálayan Bot., p. 129), speaking of the Aurantiaceæ, that he considers the orange, lemon, lime, citron, and shaddock, as distinct species, without being able to say whether the sweet kinds should be ranked as varieties of the acid or be ranked as different species.

grows wild, but the cultivated trees yield the really good fruit. Two kinds are sold: one with a thick shell, and one which has a thin shell, and is called "kághazí" akhrot; the latter is esteemed, and sells at a higher price. In Kanáwar walnuts sell at 1,000 per rupee. Pangi is famous for them; the tree grows at an elevation from 7,000 to 9,000 feet.

942.—[ ]. Hazel nuts, "findak" *(Corylus avellana).*

Were exhibited from—Simla, Basáhir (3563); Peshawur, from Kábul (3691).

943.—[3682]. Pistachio nut, fistak, pistá *(Pistacia vera).*

Peshawur, from Kábul; Kashmír (3715). Sells at 2 seers per rupee.

These are brought down to the plains in abundance, but often have a disagreeable taste of assafœtida, which is brought down also by the same traders.

944.—[3689]. Khinjik *(Pistachia cabulica* or *khinjak).* Peshawur, from Kábul. LOCAL COMMITTEE.

945.—[ ]. Almonds *(Amygdalus communis).*

Almonds are recognized in the bazar, as at home, by two kinds, bitter and sweet,—Badám talkh and shírín.

Peshawur, sent two varieties (3677-78), both from Kábul.

"Bádám" sells at 3 seers per rupee; and "bádám kághazi," or thin shelled, at 2 seers per rupee.

Kashmir, Srínagar (3709).

946.—[ ]. Apricot kernels *(Armeniaca vulgaris),* sárí or maghz khubání. Simla, Basáhir.

The stones are sold as "sárí" in the hills, and the kernel is called "maghz khubáni," from which oil is extracted.

947.—[ ] .Seeds of the edible pine *(Pinus gerardiana),* "chilghoza."

Simla, Kanáwar (3566-67); Peshawur, from Kábul (3679).

948.—[3692]. Quince seeds, "bihí dáná." Peshawur. LOCAL COMMITTEE.

Value, 1 seer per rupee.

949.—[3693]. Pomegranate seeds, "anárdána." LOCAL COMMITTEE.

Selling price, 3 seers 8 chittacks per rupee.

The fresh pomegranates come from Kandahár, where they grow of large size, beautiful red color, and of great lusciousness. There are six or seven sorts; those of Jelálábád are famous. The common pomegranates of the plains are very poor, and the color inside white or pale pink; they are chiefly useful for the seeds, or the husk of the fruit, which is very acrid, and is used in dyeing, and in medicine as an astringent: the root bark has similar properties.

DRIED FRUITS.

950.—[ ]. Dates, khajúr, &c. *(Phœnix sylvestris,* Roxb).

Date trees are found in almost all the desert districts of the Sind Ságar Doab; they grow on the borders of sandy tracts, and in land such that little else grows there. The fruit forms the staple of food in some districts, and is known by different names, according to the method by which it is preserved, split, dried, boiled in oil, &c., &c.

These date trees pay a tax to Government, which forms an important item in the "sair" revenue of some districts.

MR. COLDSTREAM writes of this tree in Muzaffargarh as follows:—It does not grow actually in the sandy desert, but flourishes on its borders in the most wretched soil, and where hardly any other vegetable exists: it is often found in luxuriant groves.

It is a current idea among natives that the palm will not grow except in soil which is or has been subject to inundation. The produce of the tree varies much according to the soil in which it is rooted. The date is here one of the staples of food, and palm groves form one of the valuable properties of the country. The produce of the palms in the Muzaffargarh Public Garden, sells for about Rs. 100 a season. Dates are sold in the bazar under three forms. The most esteemed is the "*chirwi.*" This is the date of the best palms, split up the middle (as the name imports) and dried in the sun. The second best is the "*pind,*" which is eaten as it comes from the tree, without further preparation. The least esteemed variety is "*bágri.*" It is taken from inferior trees, and boiled in oil and water. The same tree always produces the same variety of fruit, and is known accordingly.

The large succulent terminal head of the palm cut from among the mass of leaves at the top of the trees—called in Hindustání "gaddah"—is commonly eaten, it is called in Muzaffargarh, garí or gallí.

The dates of the Punjab are very inferior to the Egyptian dates of *Ph. dactylifera.*

Dates are carefully preserved when beginning to get ripe, by a piece of matting being put over the cluster to prevent the ravages of birds, &c. The right to the fruit of the trees is often the subject of

litigation. The unsightly hacking of the stem of these trees* into a sort of notched ladder is never practised here, since the manufacture of toddy, which occasions the cutting, is not allowed.

The kernels or stones of the date are esteemed medicinal. They are said, if held in the mouth, to relieve thirst; and as a medicine they are incinerated and mixed with sugar and other ingredients. A gum is obtained from the palm-tree, called "hukmchil."

Dates are exhibited from the following localities.

Gujranwalla (3644).
Gugaira (3311).
Shahpúr (3650).
Jhang (3651), species both dry and fresh.
Muzaffargarh (3652-54).
"Khajúr bhógri," "pind," "chirwi" (*vide supra*) Selling prices, 16 seers, 13 seers, and 8 seers respectively, per rupee.
Dera Ghazi Khán (3663-3665). Three varieties—Khurmah (Persian name,) chivrián (chirwi, *supra*), and bágrain (bhógri:) selling prices, 16, 6, 12 seers per rupee, respectively. The chirwi have no stones, and hence weigh lighter than the others, besides being a superior quality.

951.—[ ]. **Dried apricots (*Armeniaca vulgaris*, L.), astak, khustah, kishta and khubání, are the varieties.**

This fruit is grown with great success in some of our hill stations, and makes an excellent preserve. Large quantities are dried and exported to the plains. The unripe apricot dried hard forms the "kishta;" which besides forming an ingredient in chutneys, is also extensively used as an acid brightener in dyeing with safflower and other colors that will not bear alum. The best of the dried apricots come from Kábul and Bukhára: I find dried apricots included in the Lahaul list, under the name of "pating" (Thibetan); they are brought thither from Balti, and sell usually at the rate of 4 to 6 seers per rupee.

Samples of dried apricots are sent from the following localities :—

Kanawár (3573). Mr. S. Berkeley.
Kangra, Balti (3578).
Simla, Baghat (3572).

952.—Apricots from Kábul and Kandahár, *viâ* Peshawur; the varieties are as follows :—

(3684) "Khubání." Dried fruit for eating, containing the blanched kernels of the fruit. 4 seers per rupee.

(3684) "Astak be magz," do., without kernels.

(2685) "Khasta" dried apricots, best. 2 seers per rupee.

The trees grow in great luxuriance in Kábul and in Kághan, the people have tried grafting, but never prune or take care of the trees.

953.—[3612]. Kishta, the dried unripe apricot, from Lahore bazar.

In Kandahár there are eleven varieties of apricots. When dried, without removing the stone, they are called "taifi." Sometimes the fruit is split open, the stone taken out, and the kernel being extracted is replaced: this forms the *khubání*, a term sometimes erroneously applied to figs. The taifi is what we here call kishta, being made of the unripe fruit and very acid. A hot decoction of these is used by goldsmiths to restore the lustre to old silver and gold ornaments: the article is first heated and then plunged into the kishta solution. I have cleaned silver coins in this way with great success. Kishta is used also in making pickles and chutnies; and in dyeing as a mordant or brightener.

954.—[ ]. **Bér fruit, "unáb" (*Zizyphus jujuba*).**

This fruit is brought from Kandahár, but it is also extensively produced in the Punjab. The wild kind also produces an edible berry, and is called "kokanber." Specimens were sent from—

Kangra (Haripúr) 3576.
Hushyarpúr (3580).
Lahore (3590).
Gugaira, both wild and cultivated (3308-09).
Muzaffargarh (3655). Here the *dried* fruit is called bhógri: it sells at 1 maund 8 seers per rupee.
Dera Ghází Khán (3366), wild bér.
Peshawur, from Kábul (3691): sells at 2 seers per rupee.

955.—[ ]. Currants, zirishk.

These are of two kinds, somewhat alike in appearance; one is sweet, and grows in Kábul, &c., being a species of small fruited vine (*Vitis*); the other is acid, being the dried berberry. Currants were exhibited from—

Kangra (3579).
Basáhir (3568).
Mahlog (3560), "zirishk túrsh" (*Berberi aristata*, De C.)
Peshawur (Kábul, Bukhárá) 3696; Kashmír and Ladákh, sweet currants (3716).

* Each tree, in places where grown for this purpose, yields from 120 to 240 pints of juice. The toddy is either drunk fresh, or fermented into an abominable spirit, or boiled down into a sugar. Neither one nor the other is done in the Punjab.

956.—Amlok, the fruit (dried) of *Diospyros lotus.*

It has the appearance of a dried cherry, but darker in color. Specimens were sent from—

The Murree hills, Rawalpindi (3649).

The Thandiani hills, Hazara (3707).

The following districts exhibited collections of fruit which do not admit of further classification.

957.—[ ]. Tamarind, "imli" (*Tamarindus indica).* DEPUTY COMMISSIONER.

Rohtak.

958.—[3645]. Malta oranges. MR. A. BRANDRETH.

Gujranwalla.

This remarkably fine variety of orange continues to flourish at Gujranwalla, and bears a fruit of high flavor, far superior to the ordinary orange of the country. The sample was from MR. BRANDRETH's garden. At Delhi a very fine kind of orange is grown, under the name of "danresí."

959.—[3674]. Raisins, "kishmish surkh." Peshawur, from Kábul. LOCAL COMMITTEE. (See also under *Grapes*, No. 971).

Peshawur.

Common raisins dried in the sun: selling price, 18 seers per rupee.

960.—[3675]. Raisins, "kishmish sabz."

Raisins dried in the shade, and preserving a pale green color: 4 seers per rupee. Both these are varieties of the small raisin, called in England the "sultána, or seedless raisin."

961.—[3676]. "Munakka," pudding raisins.

These are the large ordinary grapes, dried carefully in the sun: price, 3 seers per rupee.

962. —Dágh, bloom raisins.

Prepared by dipping the finest bunches into a hot solution of lime and potash, and then drying in the shade.

963.—[3680]. Figs, anjír, from Kandahár.

One seer per rupee.

These figs are dried, flattened, and strung together, and in this state are brought down; they can be had in any city bazar.

There are two kinds of figs—one being a black fruit, and called *makkai*; the other white, and called *sáda*; the latter are locally consumed, the former are dried and strung together. In the Punjab the only fig is the small sweet but rather tasteless fruit of *Ficus caricoides*, which is black, having red seeds and pulp.

964.—[ ]. Mangoes, "ám" or "maghzak" (Arabic), *(Mangifera indica).*

Though this fruit is grown extensively, there are very few good mangoes to be obtained; the majority are small in size, very fibrous, sweet, but abounding in turpentine, and of a deep yellow color inside.

In good gardens, large mangoes are obtained, and frequently that sort which has a pale yellow pulp and a sub-acid taste. The best of all are the "paiwandi," or grafted mangoes; these are of the Bombay, Malda, and other approved sorts. They are at once known by the utter absence of all stringiness of texture, and by their delicate flavor. Natives usually prefer mangoes when they are so ripe that they have lost their firmness, and are quite flabby and soft. The best mangoes come from Múltán; also from Hushyarpúr and Karnál.

The various "nazúl" gardens (*i. e.*, Government property) are generally planted with mangoes, as well as other trees; and the right to sell the fruit is sold on contract by auction at the beginning of the season; the produce of a large garden like that of Shálimár, at Lahore, is something very considerable. Natives say that a mango tree will not bear fruit till it is 12 years old, but I have seen fruit on trees certainly not more than 6 or 7.

965.—[3686]. Dried Prunes, "álu bukhárá" (*Prunus bukhariensis*, Roxb.)

Selling price at Peshawur, 2 seers 8 chittacks per rupee. They are extensively brought to the plains, and can be bought in any bazar.

966.—[3687]. Sinjad (or zinzid, Royle).

The fruit of *Elæagnus orientalis.* This is eaten in Persia: it sells at Peshawur for 4 seers per rupee.

LINDLEY* mentions that the flowers of *E. orientalis* have a delightful perfume, and abound in honey, which is esteemed in some parts of Europe a remedy for malignant fevers.

967.—[3694]. Dried plums, "álúcha." Peshawur.

968.—[3711]. Apples. Srínagar. H. H. THE MAHARAHJA.

Kashmir.

These Kashmír apples are better

* Veg. Kingdom, p. 257.

than those of our Hills, but little superior to those of Kanáwar, grown at Sungnam.

969.—[3712]. Pears. Do., do.

970.—[3713]. Quinces. Do., do.

There are three kinds of quinces—(1), Shakkar, or sweet; (2), Tursha, sour; and (3), Miyána, or middling. The first is eaten fresh and has a delicious perfume; the second is dried, candied, &c.; the seeds of all are demulcent, and used in sherbets and as a cooling drink in fever.

971.—[3715]. Grapes, angúr.

There are several varieties of grapes recognized—The 1st is "Kandahárí," being a purple grape; 2nd, the "kishmishi," small seedless grape (producing what are called,in England "sultáná raisins"), these are of the varieties called *sahibi surkh* and *sahibi ablak*; the Khátan grapes produce the large common raisins, called "munakka;" 3rd, "Gholab dan," a white grape; 4th, "Husaini," these are the grapes that come to Lahore from Kábul, in round boxes packed in cotton wool; 5th, "Sahibi," a superior grape (white); 6th, "Fakhri," sometimes called "askari," a black grape; 7th, "Munakka" and "abjosh munakka," are grapes dried in the sun; to make abjosh the grapes are plunged into boiling water, and then dried in the shade; 8th, "Rísh bábá;" 9th, "Didah-i-gau," a white grape, with some spots on the skin, which are said to resemble a cow's eye, hence its name; pious Hindús refuse to eat this grape on this account. 10th, "Karghání" (white), called from the name of a place; 11th, "Angur Jalálábádí," called also "khatta angúr," grown at Chárbagh, a few miles from Jalálábád; 12th, "Chárangúr," grown also at Jalálábád; there is a kind of fruit which is called angúr, but is not a grape really, it is properly called "kháya ghuláma." The common sort of grapes, "rocha-i-surkh" and "rocha-i-safed," also "toran."

The green grapes that are so commonly sold in the plains in the winter time, are the "hosaíní," or "shaikh khalli" grapes; they are of large size, pale green color, and of delicate flavor, they are picked before being quite ripe, and packet between layers of cotton wool, in round boxes, made of white poplar wood, and tied up with a string of goats' hair: these are exported in thousands.

There is yet another, the "akta" grape, which produces bloom raisins, called "dágh," or more properly kishmish-i-dághi, or abjosh, which are prepared by dipping the ripe bunches of fruit into a boiling solution of quicklime and potash (hence called abjosh, lit. infused in water) before drying in the shade.*

* See Cleghorn's Forest Report, p. 224, and Bellew's Mission to Afghanistán.

Of vines in the Punjab, Dr. Henderson writes —"In many parts of the Punjab, the vine thrives quite as well as in Europe; it seems to be indigenous in Hazara, and possibly also on the Salt range, its only fault here seems to be the tendency it has to grow too luxuriantly, so that it all goes to wood and leaves. This tendency might probably be counteracted by proper cultivation and by choosing a poor rocky soil, and selecting suitable varieties of vine. There seems to be no good reason why, if the best vines were obtained, good wine should not be produced in many parts of the Punjab, particularly in the hills on stony ground, where little else will grow. I am not aware that any attempt has been made, on a large scale, to grow grapes in the Punjab for the purpose of making wine. In the plains the grape ripens at a season when the heat is, probably, too great to allow the juice to ferment properly without turning acid, but in the hills this does not hold, the difficulty there will be to get, either a climate where there is little or no rain, or to get the fruit to ripen before the rains set in. In an old number of the Calcutta A. H. Society's Journal, to which I cannot at present refer, I recollect having seen a notice of a vine found in the South of India, which ripens its fruit much earlier than the common vine of the country. I believe the subject is worthy the attention of tea planters, and others permanently resident in favorable localities."

972.—[ ]. Mulberries (*Morus Indica*).

In the Punjab there are two colors of mulberries, red and white, and two sorts of each color; one is a small oval, being rather sweet, but a most miserable fruit. The other, *called* shahtút, is a very long narrow fruit, looking almost like a caterpillar, either greenish yellow or red-black in color; this fruit is better than the first kind, but still is not much; it is *very* sweet, but has no flavor.

This shahtút must not be confounded with the real shahtút, the "royal mulberry" of Kashmir, which is the fine, large, sub-acid fruit, having a good flavor just like the English mulberry.

In Kandahár and Kábul there are ten or more varieties—some of them are preserved, dried, and eaten with almonds and raisins, or with walnuts and parched maize or lentils. In the north part of Afghanistán the fruit is dried and made into flour, the bread made from it is nutritious and fattening.

973.—[ ]. Apples, "seo," sev or palú (in the hills).

The apples that grow in the plains are small and acid, and fit for nothing but cooking; those of the

hills are brought down to the plains in the cold season. Kanáwar produces great quantities, and also from many other places men may be met travelling downwards with kiltas or long baskets full of apples and pears. Basauli, on the Rávi, is a great place for apples; they are of very pleasing appearance, large and well colored, but though sweet, their flavor is deficient.

974.—Cherry (*Cerasus sp*——), "álú bálu," and "gilás."

These are occasionally to be seen dried; but the fresh fruit is only known to Kashmir and Afghanistán.

975.—[ ]. Peach, "árú," shaftálú.

There are two species in the plains—one a round fruit, which is elongated to a point on one side, this is called "nokí" (from nok, a point); the other is a flat fruit, like the Chinese peach, and is called "tikí;" the latter is much superior, both in juiciness and flavor. At Kandahár there are two sorts, one small and strong flavored, called "bábri;" and one large and luscious, called "tirwah." Nectarines are called *Mundla árú.*

HILL FRUITS.

I have mentioned the principal of these already, *seriatim*, but there remain a few more, which it is more convenient to describe in a group.

In the Upper Hills, the apricot, jaldáru (or zardárú) is common, its kernel yielding oil. Apples and pears are also grown. There are two species of cherry, the jamuna, or *Cerasus cornuta*, and the *Cerasus paddam*; the former has black sweetish berries, which are eaten. The wild pear, called *mehal* or *kainth (P. variolosa)*, is common also in the hills: it somewhat resembles our medlar, and the fruit is sweet when it is rotten. In Kangra and Kúlú, there is a crab, or wild apple, called "ban mehal" *(Pyrus baccata)* also a quince *(Cydonia vulgaris)*.

The fruit of the "trimal," or *Ficus macrophylla*, is sold in the bazar at Simla.

There are on the Upper Sutlej some species of *Ribes (R. nubicola* and *R. glaciala)*, which are like currants, but have little flavor; also a species of gooseberry. There is a wild strawberry *(Fragaria vesca)*; and a blackberry, called "unsrí" *(Rubus flavus)*, the fruit of which is preserved. In Kúlú, the *(R. flavus* and *R. purpureus)*, "akhi," both yield pleasant fruit. In the Kúlú and Kangra list, the loquat *(E. japonica)*, and the pomegranate, "darim" *(P. granatum)*, both appear. The *mitha-tendu*, or fruit of the *Diospyros tomentosa*, must not be omitted. In the Sutlej valley *Myrica sapida*, yields a fruit useful for making sherbets. Among nuts, we find the findak, or nuts of *Corylus lacera*, sold at Simla; and the seeds of the edible pine (*P. gerardiana*) are kept for food in Kanawár, where they sell at 2 annas a seer. Above Chiní, this tree is the principal one in the forest. In the Lower Hills the fruit of the "ámla" *(Phyllanthus emblica)*, should perhaps be included: the well known plantain and mango do not occur; the latter is last seen, says Dr. Cleghorn, near Rampúr, on the Sutlej, and the former below Kotgurh. *Elæagnus conferta*, "gehaí," and *Carissa edulis*, yield fruits that can be preserved, the latter making the well known karunda jelly.

976.—[ ]. Fruit of *Hippophäe salicifolia*, Súrch (Sutlej valley). Tsarkard (Thibet); called in books, "starbu." Preserve of the fruit. Rev. H. A. Jaeschke.

This is a stout thorny shrub; the fruit is very acid, but when preserved with sugar is palateable. It is common in the valleys of British Lahaul and in Spiti; the natives chiefly value it for hedges and for fuel. The conserve (khanda) of the fruit is used by the Thibetans medicinally for diseases of the lungs and phlegm.

Of the fruits in these remote regions, Dr. Cleghorn mentions the *litsi*, a species of *Prunus*, which ripens in September and has a tolerably sweet fruit something like a cherry. Another kind is the "bilitsí," a small sour woolly gooseberry; and a currant like the European red currant, called "rasta" is largely eaten by the people.

977.—Sweet currants, "basho" (Thibetan) *(Vitis sp*—— *?)* From Lahaul. Rev. H. A. Jaeschke.

These, like the apricots, are imported from Balti.

In this class are included some curious berries or fruits, being jungle produce, which were exhibited from several districts.

978.—[3656]. Caper *(Capparis decidua)*. Muzaffargarh. Local Committee.

The fruit of the caper, called "délé," is gathered from the tree (which is called "karíl"), when it is of a bright red color and about the size of a cherry; it is used as a pickle. Karíl wood is said to resist the ravages of the white ant.

This was exhibited from Gugaira (3304).

979.—[3613]. Caper, délá. Lahore.

Used as a pickle. The sample was from the rakhs in the Sharakpúr tahsíl.

It was exhibited from Sirsa, under the name of "taint" (2648).

980.—[3614]. Pílú (*Salvadora oleoides*), fruit of the jhál tree.

Exhibited from Lahore, under the name of píujú (Sharakpúr rakh).
Gugaira (3310).
Dera Gházi Khán (3667).
Muzaffargarh (3657), "khokar."
For an account of the *tree* jhál (*see* under Timber and Woods).
The fruit is called "pilú," a name often applied also to the tree itself. It is a small red berry which covers the tree in the beginning of the hot season. This is consumed in immense quantities by the Thal villagers, who look on it as a real staple of food. A bad "pilú" crop is regarded as a calamity. When dried the pilú is called "khokar."*

981.—[3360]. Panír (*Withania coagulans*). Muzaffargarh. LOCAL COMMITTEE.

A sample was also sent from Dera Gházi Khán (3368).
Selling price, 12 to 14 seers per rupee. The shrub is called akrí, a quantity is also brought from the Hills beyond the Indus; it is used medicinally and also to curdle milk. It is mentioned in the list of Dera Gházi Khán specimens, as being given to horses.

982.—[3302]. Kúhni fruit of *Careya arborea*. Gugaira. LOCAL COMMITTEE.

983.—[3312]. Lasúrá (*Cordia myxa*). Gugaira. LOCAL COMMITTEE.

This fruit was formerly included in the European Materia Medica, and was called Sebesten, hence the plant has been called *Sebestana* (Gærtn.) The mucilage of the fruit is demulcent. The root is said to be purgative: the larger fruit is called lasúrá and the smaller variety lasúri.

The following samples of fruits preserved in syrup were exhibited.

984.—[3619-3635]. Fruits, preserved. TEHSILDAR BARKAT ALI.

Lahore.

Preserves of mango, apple, pear, melon, quince, lemon, 'amla (*Emblica officinalis*), halela (*Beleric myrobalan*), carrot, bér, ginger, and conserve of red capsicums.

985.—[3646]. Preserved lemons. Gujranwalla. LOCAL EXHIBITION COMMITTEE.

986.—[3697-3705]. Series of preserves. LOCAL COMMITTEE.

Peshawur.

Preserve of lemon, bukhárá plum, limes, rhubarb, cherry (gilás, lará siyá), apple, quince, pear, peach and water melon.

PICKLES.

The native method of making pickles is very different from the European. Their pickles are for the most part such that they will not keep good for years like those of MESSRS. CROSSE and BLACKWELL, but are prepared to last only a few days, and are consumed as soon as made; hence the majority of districts were prevented from exhibiting them. The Lahore and Gujranwalla districts however contributed a series. Pickles are either prepared with vinegar (native vinegar is generally sugar-cane juice fermented till it turns acid) or else with oil, or else with some "masálah," as mustard seeds ground up with salt, &c., which being moistened with a little oil or water, is rubbed over the vegetable to be pickled, and left until it becomes sour.

Another form of pickle is "chatni," of which there are many varieties, composed of mango, tamarind, with red pepper, "sámbhar" salt, spices, sugar, vinegar, and a number of other ingredients, varied according to the taste of the maker, or according as he wishes to produce a hot, sweet, acid, or pungent "chatni." All these articles are used as relishes by natives with their dál and rice and chapatties.

I have seen people of the lower class make their meal off large coarse chapatties, taking with each bread, as a relish, a morsel of lemon pickle prepared with oil and ground mustard seed.

987.—[3631-3641]. A series of

* MR. COLDSTREAM on the Products of Muzaffargarh.

pickles from Lahore, exhibited by TEHSILDAR BARKAT ALI.

Potato (in vinegar), galgal (in oil), lemon, dela (the fruit of the caper), (in vinegar), mango (in oil), red pepper (in vinegar), ginger, onion, apple, turnip, zamin khánd, "halela" (in vinegar), áňwla (*Emblic myrobalan*).

988.—[3647]. A jar of pickles. Gujranwalla. LOCAL COMMITTEE.

SUB-CLASS (D). TEA.

The cultivation of tea presents one of the strongest proofs we could wish for, of the advance that has been made within the last few years, from the time when Dr. Jameson first inspected the most promising localities in the Kangra hills, until now, when both in the Punjab, and in Garhwal and Kamaon, the number of tea companies, and individual planters, form a list that would cover several pages were I to enumerate them.

I propose before detailing the specimens exhibited by the various companies and individual planters, both in the Punjab and the North-West, to present a brief statement of the past progress and present state of tea cultivation, gathered from the various reports and correspondence which have been laid before Government, and which are to be found scattered through the published and unpublished records of the Governments of the Punjab and N. W. Provinces.

The idea of establishing tea cultivation in the Himálaya appears to have been entertained from a very early period. Dr. Royle quotes from a report which he communicated to Dr. Wallich for the information of the Indian Government in 1827,* while in the body of the work itself (which was published in London in 1839), a series of pages full of the most interesting details is devoted to prove that from the similarity of climate, flora and geological structure of the tea districts of China with portions of the Himálayan range, there can be no doubt that the tea cultivation would succeed.

"The flora of the mountains, including that of the most northern parts of China, shows an almost universal identity with the genera found covering the elevated belt of the Himálaya. If we commence with the bases of these mountains, and pass successively through the several belts, and (analagous to what takes place between the parallels of latitude of 40° and 45°), experience the rapid decrease of mean temperatures and the quick succession of vegetable productions, we shall first find a vegetation similar to that of the southern provinces; the agricultural products consist of rice, millet, amaranth, an esculent *Arum*, ginger, turmeric, a little cotton, and sugar at the season, succeeded by wheat, barley and buckwheat in the cold weather months. Along with plantains, oleander, and some of the orange tribe, we meet also with some species which were long considered peculiar to China, as *Marlea begonifolia* and *Houttuynia cordata*, with species of *Chloranthus*, *Incarvillea*, and *Hiptage*.

"On ascending we pass through different gradations of vegetation until reaching the regions of the oaks and rhododendrons, which is immediately succeeded by that of pines, we meet another mild region, with a flora which must approximate to that of the mountains of the central provinces of China, for here we find the Chinese genera, *Abelia* and *Eurya*, with *Stauntonia*, *Kadsura*, *Hovenia*, &c. * * * But it is in the midst of similar vegetation that the tea plant is everywhere found. It cannot be a difficult task to transfer from one country to another, a plant which grows naturally and is cultivated extensively in one which possesses so many of the plants which are common to the two, and not found elsewhere."

In a note, Dr. Royle notices still further the similarity of products of the Chinese tea districts and the Himálayas: he says—"As the camphor, varnish, wood oil, and tallow trees, constitute a part of the natural riches of China, so we have in the Himálayas and at their foot, *Camphora glandulifera*, containing solid grains of camphor in its wood,—*Melanorrhœa usitata* (Wall) yields abundance of excellent varnish, besides *Rhus vernicifera*, the varnish tree of Japan, which is common in the Himálaya. Wood oil is yielded by several species of *Dipterocarpus*: oil is obtained from apricot seeds, and from *Prinsepia utilis* in China as it is in our hills, and paper of the *Daphne cannabina* is also a product common to both—as also the butter of *Bassia butyracea*, which abounds at Almorah."

* Illustrations of Himalayan Botany, p. 127.

In summing up the arguments he has adduced, he says (p. 126): "Even supposing that the finest flavored teas should not be at first successfully cultivated, an immense consumption would be found among Asiatic nations for even inferior kinds, which would still be superior to what they now use. This would greatly increase the resources of the hill provinces, and give rise to an extended commerce with Northern and Central Asia, as the Tartar nations habitually use it; and all Asiatics, even the natives of India, think so highly of the virtues of tea, as to have recourse to it in cases of sickness.

"But at all events, an article of which the exports amount to about 50 million of pounds in weight, and in value to two and a half millions of money [this was written in 1839], is well worthy the consideration of a Government which possesses territories apparently so favorable for its cultivation."

With regard to the comparison of climate, Mr. Fortune writes:—In comparing the climate of these provinces with that of China, although we find some important differences, yet upon the whole there is a great similarity. My comparisons apply of course, to the best tea districts only, for although the tea shrub is found cultivated from Canton in the south to Tan-chow-poo in Shantung, yet the provinces of Fokein, Kiansee, and the southern parts of Kiangnan, yield nearly all the finest teas of commerce.

"The town of Tsong-gan, one of the great black tea towns, near the far famed Woo-e-shan, is situated in latitude 27° 47′ north. Here the thermometer in the hottest months, namely in July and August, rarely rises above 100°, and ranges from 92° to 100° as maximum; while in the coldest months, December and January, it sinks to the freezing point, and sometimes a few degrees lower. We have thus a close resemblance in temperature between Woo-e-shan and Almorah. The great green tea district being situated two degrees further north, the extremes of of temperature are somewhat greater. It will be observed, however, that while the hottest month in the Himálayas is June, in China the highest temperature occurs in July and August; this is owing to the rainy season taking place earlier in China than it does in India."*

Looking forward from these early predictions to the actual results attained, we find Mr. H. C. Watts in 1858, addressing the Secretary to the Court of Directors of the East India Company as follows:—

"The experiment has proved, beyond a doubt, that the climate and soil of various parts of the Himálayas are admirably adapted to the growth of the tea plant."

And he goes on to quote the words of Dr. Jameson, in his Report on Tea to the Government of the N. W. Provinces, in 1857, as follows:—

"The tea plant is thriving well from Hazara, in the Sind Ságár Doab of the Punjab, to the Kalie river, the eastern boundary of the British Province of Kumaon in the Himálayas, or over 5° of latitude and 8° of longitude."

The record of such results, so wonderfully in accordance with the early predictions of Dr. Royle, is not only interesting in itself, but important as a striking proof of the positive value of meteorologic and botanic observations; showing how trustworthy are deductions made from phenomena so recorded.

The principal tea district in the Punjab is the country around the Kangra valley, and in this place it was first introduced from plants already established in Kumaon. As my remarks are intended only to illustrate the growth of tea in the Punjab Himálayas, I am precluded from reciting the early history of the neighbouring plantations of Kumaon and Gurhwal.

In the year 1848,* two small plantations were established in the Kangra valley, under the care of Dr. Jameson, Superintendent of the Botanical Gardens, Saharunpúr, and of the tea plantations in Kumaon. In 1852, Lord Dalhousie then Governor General, on visiting Dharmsala, saw also the tea plantations, expressed his satisfaction at what had been done, and offered encouragement to further undertakings. This resulted in the establishment of the Holta plantations and factory. The plantation was formed on a tract called Holta from a village of that name in the neighbourhood: it had been left uncultivated from superstitious motives by the natives, and was by the Settlement papers reserved as the property of Government, consisting of 4,000 or 5,000 acres. The site is thus described by Dr. Jameson in a letter to the Secretary to the Government of India, dated March, 1853:—

"When the Most Noble the Governor General visited the valley, there were only two small nurseries formed from plants imported from Kumaon, in localities distant from each other, the one at Nagrota, and the other at Bowarnah in the Pálam valley, in order to show that tea could be advantageously grown.

"In these sites the plants are growing with the greatest luxuriance, hundreds being five and six feet high, and from them, last season, 227 lbs. of teas—pouchong, souchong, and bohea—were prepared.

* Selection from Public Correspondence, N. W. Provinces, part 11, page 261.

* 2nd Punjab Report, Indian Records No. VI., p. 194.

Samples of these have been forwarded to Calcutta for transmission to the Hon'ble the Court of Directors, in order that their quality may be tested by the home brokers. In addition to the teas, the nurseries yielded about a ton of seeds. The luxuriant growth of the plant induced His Lordship the Governor General, after personal inspection, to sanction the formation of an extensive plantation; and for this purpose, I selected the waste plain of Holta at the base of the Chamba range, in about north latitude 32°, and longitude 76° 30', a large highly undulating tract of waste land, bounded on either side by two considerable streams, the Awa to the east, and the Nigal to the west, which take their rise to the north in the snows of the Chamba range. These rivers completely command the plain; and their waters can, at any time, be made available for irrigation when a droughty season occurs, and it is deemed necessary.

"The plantation is from 3,500 to 4,000 feet above the level of the sea; its soil consists of a rich black vegetable mould, varying in thickness, from two feet to six inches, and rests upon a sub-soil of stiff red clay. In this clay boulders of granite abound, forming a characteristic mark of the valley. These boulders occur of all sizes, varying from fifty feet in height, and three hundred feet in circumference to the size of a pea, and in every locality: to the alkali in the felspar which they contain, is owing, in a great measure, the fertility of the soil. In all places the drainage is good; the whole land being highly undulating, and dipping under an angle varying from 4° to 25°. The plain, if such a term can be applied to a tract of land consisting of a series of small hills and valleys,—spurs issuing from the Chamba range and dipping to the south,—is of great extent, almost entirely waste, and used by the Baipurees for grazing their cattle. On it but few trees are met with, consisting of the cheer (*Pinus longifolia*), oak (*Quercus incana*), elyár (*Andromeda ovalifolia*), &c., characteristic of considerable altitude.

"Here snow falls annually during the months of December and January, and lies for some length of time. The tea already prepared, the produce of leaves of the Nagota and Bowarnah nurseries, is very highly flavored; and as the altitude of these places is much below Holta, I doubt not, but that this plantation will produce teas of a very superior description. The Chinese tea manufacturers, now employed there, state that the leaves grown in the Kohistán of the Punjab, are superior to the produce of Kumaon and Gurhwal for manufacturing teas; and they speak from experience, as they have been working in both places. With their opinion I coincide, and attribute the advantages to the heavy falls of snow and rain which annually take place in the cold weather in the Kohistán. In China, in the northern districts, where snow continually falls in the cold weather, the teas are found to possess the highest aroma; and, probably, the same will be found to be the case with the Punjab teas, and they will thus command the greatest sale and highest prices."

The subsequent progress of the Holta factory is thus noticed in a letter from the Secretary to Government of the Punjab to the Secretary to Government of India, dated June 11th, 1859.

"Year by year the cultivation has extended, until it now occupies 800 acres, bearing some five millions of plants. It is estimated that the produce of this year will amount to 26,000 lbs. of excellent tea, valued at Rs. 52,000, or £5,200; and that when in full bearing, the yield will increase to so large an amount as Rs. 1,50,000. The expenses are computed at Rs. 16,000; there is, therefore, a very considerable profit, besides which, vast quantities of seeds and seedlings are distributed gratis to the native landholders of the district, with the view of diffusing the culture of the plant."

Since these days the spread of tea cultivation has been extensive, and at the present day, there are both Natives and Europeans producing tea. Of the qualities of this tea I shall speak presently. Some idea of the rapid extension of cultivation and formation of new companies may be gathered from the following passage from a report addressed to the Government N. W. Provinces by DR. JAMESON. The cultivation has probably now exceeded the limits: in fact every year adds to the number of cultivators and companies.

"In the Pinjore Dhoon, the MAHARAJA OF PUTTIALLAH has formed a small plantation, by the assistance of BAHADOOR SINGH, a highly intelligent native, son of the late Chowdree of the Saharunpore gardens, and to him a large supply of seeds and 20,000 plants have been given for extension.

"In the Simla hills, GENERAL INNES and MAJOR GOAD have both formed plantations, and are actively carrying on the cultivation; and to them large supplies have been given.

"At Kotghur, to the north of Simla, a small company, represented by MR. S. BERKELEY, has been formed, and by it a small quantity of fair, marketable tea has this season been prepared by native tea makers supplied from the Government factory in the Kangra valley. To enable them to extend operations a large quantity of seed has been given.

"To the westward, in Kúlú, MR. KNOX, the Assis-

tant Commissioner, has formed a small plantation, which is thriving vigorously, and to him, for extension, a large supply of seeds has been given.

"In Mundee, the VUZEER GOOSAIN has commenced the cultivation.

"In the Kangra valley, numerous parties, both Native and European, have taken up the cultivation with vigor and energy.

"At Beijnath, CAPTAIN FIZTGERALD, representing a company, has settled, and is actively engaged in breaking up land and planting.

"To the east of Holta, DR. CRAWFORD has established a plantation at Lanode.

"At Bawarna, MR. JUDD has taken up a considerable tract of land, and there formed a plantation.

In the immediate neighbourhood of the Holta plantation, several parties have established themselves.

"To the south, on the waste plain of Holta, the Nassau Tea Company, have established themselves on the land given by Government to MR. ATHERTON, late of the Civil Service, to form a colony of Christians. By him a number of natives were brought in to the Kangra valley in order to cultivate this waste land. Seeing, however, the heavy work before them in order to obtain a livelihood, the native Christians to a man deserted, and thus left the proprietor without cultivators. He therefore sold the land to the Nassau Tea Company for Rs. 3,600. This land, stated by the natives to be unfit for any kind of cultivation, was selected and made over to me by orders of Government in 1850-51, and part of which now forms the Holta tea plantation.

"To the west of the plantation, at Bundlah, the Kangra Tea Company, represented by MR. MEAKIN, have taken up a large tract of country, and are carrying on operations with great vigor.

"Further to the westward, and near Bundlah, CAPTAIN DUFF, representing a company, has settled.

"Still further to the west, CAPTAIN BATT, also representing a company, has established himself.

"In the neighbourhood of Dhurmsala, CAPTAIN YOUNGHUSBAND has formed a plantation.

"At Shahpúr, in the Pálam valley, COLONEL BURNETT has commenced tea operations."

In 1853, the yield of the two original plantations, and the first gatherings of the new Holta plantation, were in all 546 lbs. 8 oz. *

This produce was sold in March 1854, with some additional produce, making a total of 709 lbs., which fetched a total of 977 Rs.

In 1854 to 1855, 1,682 lbs. produce, sold for Rs. 3,140-10-8; and 1855-56, 5,077 lbs.; sold for Rs. 6,854-3-10.

The expenditure on the plantation was then Rs 8,502 per annum.*

In 1859-60, the out-turn of tea was as follows:—

	lbs.
Black—Souchong, ...	1,870
„ Pouchong, ...	22,480
Green, ...	4,942
	29,312

And in 1861-62, the following quantities are reported:—

	lbs.
Black—Souchong, ...	7,018
„ Pouchong, ...	4,007
„ Bohea, ...	14,056
Green—Hyson, ...	365
„ Young do., ...	491
„ Gunpowder, ...	81
„ Imperial do., ...	41
„ Hyson skin, ...	475
Total, ...	26,532

This year, 1861, yielded somewhat less than 1860, but the deficiency was, I believe, owing to unusual drought. The general increase, however, is very remarkable; and there seems no reason why the cultivation should not increase still further. DR. JAMESON says, in the letter above quoted:—"These remarks show that the idea generally prevailing that the land fitted for tea cultivation is limited, is erroneous; and were all the lands in Kumaon, Garhwal, Kúlú, Kangra, to be employed, teas could be prepared in sufficient quantities to supply both the Indian and European market." And again:—"The Kangra valley is about 60 miles long, and averaging 10 miles in breadth, of it at least half is well adapted to tea cultivation; much land well fitted for the same purpose is to be met with in Kúlú, Mandi, &c., and throughout the western hills." A nursery has been formed at Kanghar in Kúlú, and the plants thrive admirably.

The Administration Report† for 1863-64, shows a still further increase in tea. The area under cultivation was brought up to 600 acres, the yield of tea was 24,777 lbs., of which 4,720 lbs. were prepared from leaves purchased from zemindars; this shows an increase from the last year of 8,652 lbs. In the same year 570 maunds of seed were distributed to Europeans, and 191 maunds to native planters; also seedlings to the number of 1,769,000. The price of tea seeds was fixed at Rs. 20 a maund; seedlings are

* 2nd Punjab Report, India Records, VI., 194.

* 3rd Punjab Report, Indian Records, XVIII., 112.

† Report for 1863-64, p. 143, para. 285, *et seq.*

sold at half an anna each, whereas the original plants from China cost Rs. 40 a piece !

In the Report for 1864-65, will be found at para. 408, a summary of the results of the attempted cultivation in the Murree hills, at Seelah, Tret, Shamlí, and other localities; they show that the plants live, but the results are not very encouraging.

At the Government factories, the out-turn for the season of 1864 was 40,246 lbs., of which 5,451 lbs. were purchased from native cultivators. The average price realized was :—

Description.	Maximum.	Minimum.	Average.
	R. A. P.	R. A. P.	R. A. P.
1st class green, ..	1 12 0	1 6 0	1 9 8
Hyson skin, ..	0 8 0	0 6 0	0 6 5
Fine souchong, ..	1 12 0	1 8 0	1 11 5
Souchong, ...	1 10 0	1 8 0	1 8 8
Pouchong, ...	1 0 0	1 0 0	1 0 0
Bohea, ...	0 12 0	0 8 0	0 8 9

54 tons of seed were distributed to Europeans, and 16 tons to Native planters, and no less than 1,769,033 seedlings. The Government having now seen the tea culture fully established, has sold these factories to private hands.

Sir Robert Montgomery has left on record a Memo. on the Kangra Tea Plantations, which forms Appendix IX. to the Report for 1864-65.

The cultivation of the tea has proved on the whole very acceptable to the hill people. All natives have at first an aversion to anything new, but Government made good terms for zemindars who would grow tea. It distributed gratis large quantities of seed and young plants, and a guarantee for a fixed period was given to the zemindars to buy the leaves they produced at the rate of Rs. 8 per maund. If advances were made to a zemindar, he was bound to continue the cultivation till he repaid in the value of raw leaves.

The cultivation of tea appears to have been taken to in the hills by classes of men who had the most violent aversion to ploughing or any other form of agriculture.

The castes of Rajpúts were of this class. It was estimated in 1853, that there were more than 10,000 of this caste, who were remnants of the Sikh armies, or of bands kept up by the Rajahs of petty states in the hills: they considered it derogatory to their caste to plough, but would work with the spade ; and Dr. Jameson writes, that hundreds of Rajpúts had applied for employment at Holta, so long as they were not to use a plough. As a large portion of the Holta tract was of necessity broken up by the spade, numbers of these men were employed.

The cultivation of tea appears remarkably simple. A few seeds are dropped into small holes, made at certain distances apart in rows. The young plants require weeding. Mr. Robert Fortune visited the N. W. Provinces plantations in 1851, and remarks that the best soil was a sound, light loam, well mixed with sand and vegetable matter, moderately moist ; that land on the hill sides is to be preferred to low flat lands. Mr. Fortune remarks on the system of irrigation practised, and asserts it to be injurious. A Chinese manufacturer, who accompanied him, seeing the plants artificially irrigated in the Indian manner, observed that was the way in which they cultivated *rice* in China.

Mr. Fortune adds that, when tea will not grow without irrigation, it is a sign that the land is not suited for the crop, but he does not preclude irrigation in a season of drought, or as an exceptional measure.* Plucking leaves from very young plants is highly detrimental, as it weakens the plants and renders them unproductive. With regard to the quality of the tea produced, it may be observed generally that the rapid extension of its cultivation, the high prices at which it sells, and the demand that exists for it among Europeans, sufficiently proves it to be of the best quality.

It is made of all the usual China varieties, of both green and black tea.

The weight of evidence goes to show that green and black tea are of different species, which are distinguished by the names *Thea viridis* and *Thea bohea*. The *Thea viridis* has one distinction, that it is very much hardier than the *Bohea* ; it is grown in the northern tea districts of China, where snow and frost is not very unfrequent. This variety has been known to flourish in England in the open air.†

Thea viridis is described as a large strong growing plant with spreading branches, leaves from three to five inches long, very broadly lanceolate, pale green, singularly waved, with the margin reflexed. *Thea bohea* has smaller sized leaves (not above half or two-thirds the size of the former), erect stiff branches, the leaves being perfectly flat, more coriaceous, of a dark green, and the plant cannot bear the frost of an English winter. Dr. Royle quotes Mr. Reeves, to whose opinion he attaches great weight, from his

* Selections from the Public Correspondence of the N. W. Provinces, Part XI., No. 56.

† See Royle's Himalayan Botany, p. 109-110.

long residence in China. The latter expresses surprise, that any one who had been in China, or had ever noticed the difference in color between the infusions of the two varieties, could suppose for a moment that they were the produce of the same plant, differing only in the mode of curing; particularly as they do not grow in the neighbourhood of each other. It appears, however, that black tea, can be prepared so as to form a green tea, which fact has here given rise to an opinion that the two sorts are identical in their origin.

In China the *green tea* district is included between the 29° and 31° north latitude, and the *black tea* district, between 27° and 28°.

It appears that the tea plants may grow luxuriantly *as plants*, in localities where the leaf invariably turns out so ill-flavored, as to make the cultivation unprofitable. Tea has been tried in Penang, but though the plant grew, the tea was bad; a similar result was experienced when tea was attempted at Rio Janeiro.

This effect of climate and situation is remarkable. The hill teas in the Punjab and North West are very different in flavor from the teas of Assam; and those again from the teas of China. Some of the hill teas have a tendency to become very bitter in infusion; on this account it is a common custom to mix them with the China tea. MR. FORTUNE, in 1851, urged the importance of taking pains to procure from China, seeds and plants of really superior varieties, and stated that the first tea plants brought to Kumaon had been brought from some districts in the south of China, and from very inferior plants, merely owing to the greater facility of obtaining and removing them from the particular locality. Much improvement has been effected since then, but the subject still requires to be kept in view.

There can be little doubt on the whole, that the Kangra and other Punjab hill districts produce trees of the finest quality and aroma. Even in 1854, when the first lot of 709 ℔s. was sold, the souchong fetched from Rs. 1-15 to 2-5 per ℔; pouchong, Rs. 1-3 to 1-8; and bohea Rs. 0-12 to 0-15; and DR. JAMESON pronounced these teas to be the finest yet produced in North India.*

* 2nd Punjab Report, Indian Records, No. VI., p. 195.

Before enumerating the exhibited specimens, it is necessary to take a passing glance at the Punjab tea-trade, from China and other sources.

Tea is not a beverage of general consumption in the Punjab, except among the Kashmíris,—colonists who having left their original homes in Kashmír, have settled in the Punjab, in Jalálpúr, Amritsar, Ludhiana, and other places, bringing with them their shawl-weaving trade, and their class of Kashmíri pandits who become moonshees and writers: all these consume tea largely. As yet the hill teas have an inconsiderable sale among natives generally; they command prices which are too high for the ordinary class of purchasers. The imports of China tea by Calcutta are considerable. In 1852, 25,000 standard maunds of tea came to Amritsar, of which about 2,000 passed on to the Kashmír territory.

Kashmir is also supplied from Chángthán *viá* Lé, but this tea is principally consumed at Jammú, Kashmír and Ladakh; the last place is dependent on this source.

Black and green tea in cakes, called "dhámún," is imported to Lé from Chángthán, to the value of Rs. 30,000.

Lhassa tea appears to have now become an article of import. The names of the China teas imported by land are—Green, "karakokla," "khushbo" (scented), and "sabad" (green). The black is called "takhta siya."

As before remarked, most natives esteem tea as a valuable beverage by way of medicine; but there is every probability that tea, if cheaply obtainable, would be universally consumed At present, even the cheaper tea, at Rs. 0-12 a ℔., is beyond the reach of ordinary natives; while the good kinds, at Rs. 2 and 2-4, they would not think of buying. The hill tea of the Punjab is hardly at all to be met with in the bazars of the large cities as yet, but China tea imported by sea is used; also, occasionally, brick and other Thibet and Chinese teas are to be seen, which have made their way down from the remote markets before alluded to.

I conclude this sketch with a table showing the existing plantations in the West Himálaya, exclusive of the late Government plantations at Holta and Dharmsala, and those in the Murree Hills.

	Locality.	Name of owner or manager.	Extent of estate in acres.	Number of acres planted.	Number of acres prepared for planting.
1.	Shahpúr, and its vicinity,	Col. Barnett, ...	250	76	..
2.	Dharmsala, ...	Capt. White, ...	162	50	..
3.	Kanyárá (near Dharmsala), ...	Mr. Shaw, ...	340	120	40
4.	Gopalpúr and vicinity (between Dharmsala and Holta), ...	Kangra Valley Tea Company,	557	No information.	
5.	Kusmál (near Holta), ..	Mr. Mackay, ...	200	150	50
6.	Ditto, ..	Capt. Batt, ...	700	150	100
7.	Bandlah (near Holta), ..	Capt. Duff, ...	1,075	200	50
8.	Holta, ...	Nassau Tea Company, ..	2,960	416	..
9.	Near do., ...	Mr. Conlan, ...	57	10	..
10.	Bandla, ...	Kangra Valley Tea Company,	320	No information.	
11.	Lanod (near Holta), ..	Dr. Crawford, ...	700	60	..
12.	Baijnáth, &c., ...	Capt. Fitzgerald, ...	1,120	200	20
13.	Dewal, ...	Mr. Blewith, ...	198	..	..
14.	Ditto, ...	Mr. Gordon, ...	389	4	. 0
15.	Sansál, and other villages,	Dr. Crawford,..	495	No information.	
16.	Kálú valley, ...	Lieut. Knox, ...	700	400	250
17.	Ditto, ...	Kálú Valley Tea Company, ..	264	23	13

The exhibited samples of tea were as follows:—

989.—[3717]. Tea, from Rámpúr, Simla. Basáhir. Mr. Ter Arratoon.

990.—[3718]. Tea. China. Mr. Stephen Berkeley.

Chinese tea imported from the Thibet frontier.

991.—[ ]. Tea, from Kotgurh plantation. Mr. S. Berkeley.

Souchong—pouchong—hyson—gunpowder.

992.—[3719]. Souchong tea, manufactured by Ghasitu of Kangra. Banáurí, Holta.

993.—[3720]. Fine souchong. Do.

994.—[3721]. Tea dried in the sun without fire. Do.

995.—[3722]. Pouchong tea. Do.

996.—Series of teas by native manufacturers, located in the Kangra valley, viz.:—

(3723) Nara Pahwari of Pathíyár.

(3724) Bali Ram of Saliyána.

(3725) Ram of Nagrota

(3726) Jaishi Ram (late E. A. C. of Dharmsala).

(3727) Jog Raj, Jaghírdár.

(3728) Chitu, Lambardár of Púnah.

997.—[ ]. Tea, at Rs. 2 per lb. Kangra Valley Tea Co., Bandla Estate. Manager, Mr. Napier Lennox. Manufacturer, Ishru.

998.—Tea, at Rs. 1-8 per lb. Do., do.

(One ½ lb. sample of each).

999.—[3731-32]. Tea, from the Byjnáth plantation. Captain Fitzgerald.

1000.—[3733]. Tea, at Rs. 2 per lb. Bandlah Tea plantation. Mr. J. C. Fergusson, Manager.

1001—[3734]. 53 lbs. pekoe tea. Nassau Tea Company. Mr. R. Bailand, Local Manager.

At Rs. 2-4 per lb.

1002.—[3735]. 46 lbs souchong. Do.

At Rs. 2 per lb.

1003—[3736]. 46 lbs. pouchong. Do.

At Rs. 2 per lb.

1004.—[ ]. Caper tea, Kanyárá plantation, Dharmsala. Mr. Shaw.

1005.—[3737-3743]. Series from the Government Factory, Holta. Dr. W. Jameson.

(Not sent for competition).

Black, Fine souchong—souchong—pouchong.

Green Hyson—young hyson—gunpowder—imperial gunpowder.

1006.—[3729-30]. Tea, from Kúlú Tea Company, Bajaura. Mr. Miniken, Manager.
Kulu.

1007.—[3744]. Moss tea. ("Sbángja," *Thibetan*). Rev. Mr. Jaeschke.
Lahaul.

This plant, which looks like a large kind of soft moss, occurs high up on the hills in the neighbourhood of the remote summer pastures, where the poor herdsmen use it as a substitute for tea, preparing it in the same manner as the Thibetans and Mongols do the genuine tea, which it—as almost any plant prepared in this way would do—resembles in taste, but it is disagreeably bitter.

1008.—[3745]. Brick tea, enclosed in the skin in which it is wrapped for protection. (*Thibetan,* "Japag"). Rev. Mr. Jaeschke.

Imported from China. It is prepared by pounding, after which it is boiled in water, mixed in a sort of churn with butter and salt.

1009.—[3746-49]. Series of teas, imported from China and Thibet, largely consumed in Kashmír. H. H. The Maharaja.
Kashmir.

Brick tea, dhámún; black tea, cha siyah; green tea, cha sabz; fine quality, do.

The following teas were also sent from the various plantations of Kumaon, N. W. Provinces.

(3750-54). Series from the Kousanie Tea Company. Kúsáni in Kumaon. K. McIvor, Esq.

5 lbs. of souchong, at Rs. 2 per lb.
Brick tea (5 lbs. each brick), at prices varying from Rs. 2, 1-8 and 1 per lb.
5 lbs. hyson, at Rs. 3 per lb.
5 lbs. young hyson, at Rs. 2-8 per lb.

(3755-56). Teas by the Kumaon and Kuttyoor Company. Katyúr, Kumaon. C. J. R. Troup, Esq.

10 lbs. of pekoe souchong, at Rs. 2 per lb.
10 lbs. of souchong, at 1-8 per lb.

(3757). Warrand-field plantation, Gwáldúr, Garhwál. T. A. Warrand, Esq.

5 lbs. souchong, at Rs. 2 per lb.

(3758). Lockington plantation. Katyúr, Kumaon. R. Story, Esq.

5 lbs. souchong, at Rs. 2 per lb.

N.B.—The great importance of this Sub-class, as well as the distinctive nature of the substances it contains, induced the Central Committee to appoint a special Jury, whose Report on the samples exhibited for competition now follows:—

REPORT ON TEA.

SECTION A. CLASS III.

DIVISION I.

SUB-CLASS (D.)

JURY.

LIEUT.-COL. LAKE,
D. F. McLEOD, ESQ., C.S.,
MAJOR MERCER, DEPUTY COMMISSIONER OF AMRITSAR,
DR. W. JAMESON,
MAJOR DENNIS,
WAZIR GUSAIN,
MAJOR-GENERAL INNES.

REPORTER—DR. J. L. STEWART.

THIS Jury have been fully impressed with the responsibility of their task, the gravity of which depends chiefly on two causes, viz., the daily increasing importance of the rising tea-trade of the Himálaya, and the possible mercantile results of their adjudications.

While the cultivation and manufacture of tea by private enterprize in the Punjab Himálaya is but of very recent date, tea is so rapidly tending to become a staple product of these mountains, that it is scarely possible to exaggerate the bearings of the subject on the future prospects of colonization in them. Six years ago there was hardly an acre of tea land in private hands to the west of the Jumna; now, many thousands of acres have been taken up by planters for the growth of tea, and hundreds of acres—especially in the Kangra valley and its neighbourhood—are already covered with tea plants of considerable growth. Although the qualities of the tea manufactured on the Government plantation, under the superintendence of DR. JAMESON, the creator of tea culture in North Western India, is well known, yet the cultivation of the shrub by private planters in the Punjab Himálaya is so recent, that as yet but little tea manufactured by them has found its way into the market; and, perhaps, this fact rendered it of still greater moment that the Jury should consider maturely the various circumstances on which their decisions should be based.

The qualities of the competing teas, which are most attended to in deciding the commercial value of the article, and which have weighed most with the Jury are the following:—Color of both black and green teas, selection of the leaves as indicating careful gathering, picking and sifting, twist of the leaf, aroma and flavor, and qualities as a beverage when infused. Much attention has been directed to each of these, so as to arrive at a fair adjudication.

The only districts (within British territory) whence teas have been sent are Kangra, Simla and Kumaon, which include most of the tea-growing tracts within easy reach of Lahore.

The kinds of tea sent are the following:—

Black—Flowery pekoe,	Black—Brick souchong.
" Pekoe,	" Pouchong.
" Pekoe souchong,	Green—Hyson.
" Fine souchong,	" Young hyson.
" Souchong,	

In addition to these were exhibited mixed (black and green) tea, and a specimen made by sun-drying without fire; and gunpowder and imperial gunpowder were included, in a complete set of the teas ordinarily made at the Government plantation, Holta, Kangra, sent by Dr. Jameson for exhibition, but not to compete.

Mr. Shaw, of the Kanyárá plantation, Dharmsala, exhibited a specimen of caper tea, and favored the Jury with an interesting detailed account of the method in which he manufactured it. The flavor is good, and it seems well adapted for a mixing tea; but it is doubtful if it could be manufactured to sell at moderate, and at the same time remunerating, prices. The Jury consider it right to award Honorable Mention to Mr. Shaw for this tea, as it is of some importance that the manufacture of "fancy" as well as ordinary teas should be attended to.

The only foreign teas exhibited,—besides some specimens grown in the territories of H. H. the Maharaja of Kashmir,—were Chinese tea, also sent by His Highness; and two specimens of "brick tea" (*kaiel cha* in Chinese, *zang cha* in Basáhir), the ordinary form in which the Chinese article is imported *viá* Thibet. This, in its unsophisticated state is described as being made in China from the coarsest leaves, and the refuse and broken tea, agglutinated by means of bullock's blood; but one at least of the specimens exhibited contains 50 per cent. of bits of branches, and little of the remainder appears to consist of genuine tea leaves. Its infusion, prepared in the English method, is extremely nauseous, but it is said to be much relished by the Turanian races beyond the middle Himálaya, cooked and eaten as a broth, with the addition of butter and salt: although Europeans who have tasted it thus made, mention it as far from agreeable. But little Thibet tea finds its way into the Lahore market, where it is seldom sold cheaper than Rs. 2-8 a seer, while the brick souchong, exhibited by the Kousání Company, presumably for the Thibetan market, is not so dear, is a purer tea, and is unquestionably much more palatable to a non-Thibetan taste.

The Rev. Mr. Jaeschke of Lahaul, sent for exhibition a very interesting specimen of what is called "moss tea;" called in Thibetan "sbangja," from which a beverage is prepared on the Upper Chenab. This consists of the thick rhizomoid roots, and lower leaves (mingled with moss, &c.) of a small herbaceous plant, with scabrous leaves, which in this state it is impossible to identify with certainty.

An interesting article exhibited was a "*masála* for tea," which has been found by Dr. T. E. B. Brown, Chemical Examiner to Government, to consist almost entirely of carbonate of soda, with a small admixture of chloride of sodium and alum, as impurities. This is used for imparting to green tea what is technically called the "bloom," and for bringing out the astringency of the article. There is no doubt that the use of such substances heightens the color, beauty and astringency of the tea, and so long as only carbonate of soda

is used no harm is done, as this is quite innocuous, and frequently added to tea by the housewife at home to make it "draw;" but the Jury take leave to deprecate the use by the Himálayan tea manufacturers of alum and other more powerful astringents, the long-continued use of tea having any considerable admixture of which must be most deleterious.

It is worthy of note, that no adulteration by coloring matter was detected in any of the teas sent to the Great International Exhibition of 1862, and the Jury are glad to have it in their power to say as much for the Punjab Exhibition of 1864. Only four specimens of green tea were sent for competition, and the Jury have found some difficulty in deciding on their merits. A Money Prize and Honorable Certificate has been awarded to one of them.

Most of the Himálayan teas exhibited are sent by European tea planters, but a few are contributed by natives. The Jury feel bound to say that the teas sent by the latter are as a rule very much more carelessly prepared than those of the former. Before teas made by native growers become readily saleable at fair prices, much more attention must be directed by them to the *manufacture* of the article, on which so much more depends than on its growth. At the same time several of the specimens sent by natives are very creditable, and as the pains bestowed on these deserves to be encouraged, two Money Prizes have been awarded to the finest specimens, the better of which in particular is a well-made and excellent drinking tea.

The awards of this Jury are as follows:—

"For the best specimen of first class tea, grown and manufactured in the Punjab." Major Dennis' Special Prize of Rs. 100. Kooloo Tea Company (3729).

"For the best sample of black tea grown in India." Messrs. McIvor & Co's first special prize of Rs. 75. Kooloo Tea Company (3729).

"For the best specimen of black tea grown in India." Second prize of Rs. 50. The Telwara Tea Company (Mr. Warrand), Kumaon (3757).

"For the best specimen of black tea grown and made by a native" (3720). Local Exhibition Committee. Kangra Valley (Invoice No., 108), Rs. 100.

"For the second best specimen of black tea grown and made by a native" (3719). Local Exhibition Committee. (Invoice No., 107), Rs. 50.

"For the best specimen of green tea" (3753). Hyson of Kousání Tea Company, Kumaon, Rs. 50.

"For a specimen of caper tea." Certificate of Honorable Mention to R. B. Shaw, Esq., Kanyárá Tea plantation, Dharmsala.

J. L. Stewart, M.D.,
Reporter for Special Jury on Tea.

Lahore,
15th *April*, 1864.

Memo. on Defect in Packing Tea.

Those only are mentioned which have led to or might cause grave inconvenience.

1*st.*—Most of the native made teas were sent forward packed in wood and paper, or paper only. This by no means gives the tea a fair chance as to aroma, &c., with those which are properly packed in lead or other metal.

2nd.—There ought to be a label and number inside as well as outside, each box, and the word "top" marked on the side at which it is to be opened in order to prevent confusion. Defects in this respect have caused considerable difficulty to this Jury, and might have led to grave mistakes.

3rd.—Very many of the teas sent for exhibition were by far too new to give them a fair chance in competition with other better seasoned teas.

J. L. Stewart, M.D.

SUB-CLASS (E). INTOXICATING DRUGS.

This class is not a very interesting one, nor is there anything in it that is likely to be of any great commercial value, save opium. The principal articles exhibited under this class were :—

Numerous specimens of poppies, or both large and small, and opium.

Bhang, both the leaves and the seed, which is extensively used, being drunk either as an infusion in water, or made up with flour into cakes, and with sugar, &c., into a sweetmeat called "majún;" both cakes and sweetmeat acquire a dull green color from the bhang juice.

"Charras," the gum resin, exuding from hemp, formed part of this collection.

And, lastly, there was tobacco of several varieties—prepared as tobacco, or in the form of snuff.

It is scarcely necessary to remark that opium is not made a Government monopoly as it is in Bengal; the people are free to cultivate if they choose, only it ranks as a "zabtí" crop and has certain higher charges made upon it: the sale of opium, poppy-heads (quite a separate thing), bhang, ganja and charras, which are collectively termed "maskarát," is restricted, and these articles are the subject of an excise-duty. The right to sell maskarát is usually farmed out to a contractor, the contract being sold to the highest bidder. The upset price is the estimated value of the duty realizable for the quantities sold in a given district in a year. The contractor has under him various licensed shopkeepers, who arrange with him to receive so much drugs and pay him so much as returns of sale per diem; if they make more than this sum the surplus is their own; if they cannot dispose of all the drugs they have engaged to receive from the farmer of contract, they have to pay him so much in consequence. The sub-contractors or retailers of drugs are sometimes losers, but the contract farmers often make considerable profits: the price at which the drugs are retailed is fortunately very high. The effects of bhang and charras are most deplorable, producing redness of the eyes and a wild ferocious disposition in the drinker. Opium is largely consumed by being sometimes smoked in a huka, to be presently described, called *madhaki*, or else swallowed in little pillules. Those accustomed to it, take it at fixed hours and when they wake up from the effects, take pure milk which is believed to have a restorative effect; people who are habituated to opium cannot gave it up without danger.

I have subjoined a table showing the annual revenue derived from the Drug and Spirit Excise, from 1849 to 1865. Up to 1860-61, these two items are given together, so that the table includes both. In 1860-61, for the first time they are given separate. Since then, from 1861-62, when the Sudder Distillery system was introduced, they have always been kept separate.

Year.	Amount yielded by both spirits and drugs.	Drugs alone.	Remarks.
	RS.		
1849-50	2,78,132	...	
1850-51	3,02,452	...	
1851-52	3,33,670	...	Balances due was Rs. 8,221-2-10.
1852-53	3,17,510	...	Do., Rs. 13,697.

Year.	Amount yielded by both spirits and drugs.	Drugs alone.	Remarks.
	RS.		
1853-54	5,36,795	...	
1854-55	5,37,562	...	
1855-56	6,07,578	...	
1856-57	5,99,393	...	
1857-58	5,04,498	...	This is the amount as given in the Report from 1856-57 and 1858, but in the Report for 1859, the revenue of this year is quoted as Rs. 4,30,502, probably excluding Delhi.
1858-59	6,64,224 6,74,356	...	The 1st number does not include Delhi, the latter number probably includes the Delhi territory, as the amount is quoted in the Report for 1859-60, page 24.
1859-60	7,45,357	...	
1860-61	6,16,287	2,38,751	
1861-62	5,86,853	2,31,714	Deducted result.
1862-63	5,79,012*	2,37,350	Balance due on drugs being Rs. 22,210.
1863-64	6,97,174†	2,60,939	Do. do., Rs. 12,077.
1864-65	7,85,007	3,14,464	Do. do., Rs. 11,869.

1010.—[ ]. Tobacco (*Nicotiana tabacum*, and other species), tamákú.

This plant is a native of America, and was first known in 1492, by COLUMBUS and his followers. It is remarkable as having the widest range of cultivation of almost any economic plant, and its use even where not cultivated is so universal, that it would be difficult to find a place where it has not reached between Spitzbergen and New South Wales. In the earlier times legislative prohibitions to tobacco smoking were common; but the medicinal virtues of tobacco were admitted and indeed extravagantly asserted.‡ The universal practice of smoking in the East is very remarkable, but it has been introduced: not only is there no indigenous wild species of tobacco in Asia, but there is evidence to show that it was not introduced before the 17th century, LANE says that tobacco was introduced into Turkey and Egypt in the 17th century, and to Java in 1601.

The Sikhs are the only race whose religion teaches them not to smoke tobacco; they have, however, no objection to other narcotics, opium and bhang. Snuff taking is not so common. Smoking was not prohibited by the first nine Gurús, but only by the tenth Gurú, GOBIND SINGH, whose chief objection to it appears to have been that the habit was promotive of idleness, as people would sit smoking and do nothing. At a time when the Gurú was in great difficulties, and his few followers were flying from the servants of Aurangzeb, he had need of diligence and watchfulness, and could not afford to encourage the too prevalent habit of "*baito*."

The Mussalmans, in a religious point of view regard the act of smoking as an "act indifferent," being of the class of "biddat"—things which having come into existence after the death of the Prophet, are therefore neither enjoined nor prohibited by him, and hence are accounted "indifferent."

The species of tobacco recognized* are—*N. tabaccum*, L.; *N. latissima*, Müller, including *N. fruticosa* L., and *N. chinensis* (Fischer), the source of the large Havannah cigars. *N. rustica*, L., indigenous in America, and found wild in Europe, Asia and Africa, is the source of *Latakia* (Laodicea), *Salonica* (Thessalonica) and Turkey tobaccos. *N. Persica*, Lindley, is the Persian or Shiraz tobacco; *N. repanda*, W., is the source of the small Havannah or Queen's cigars; besides these are the species *N. quadrivalvis*, Pursh.; *N. nana*, Lindley; *N. multivalvis*, Lindley.

DR. BIRDWOOD says that *N. tabaccum* is cultivated in the Deccan, and *N. rustica*, northwards; also that *N. Persica* has been introduced into Bombay.

At present native tobacco is not used by Europeans, but quite recently an attempt has been made at Jálandhar to grow and prepare tobacco in the European way; and samples of cut cavendish and honey-dew, prepared by MR. E. TAYLOR, formed part of the collection.

With regard to the introduction of smoking in India, it is stated in the "Khulásat-ul-Tawarikh," that tobacco was introduced by the Portuguese in the latter part of AKBAR'S reign, and the beginning of JEHANGIR'S. JEHANGIR in the 14th year of his reign, when at Lahore, forbid the practice, and persons who smoked were to have their lips cut. Tobacco was introduced into Persia about the same time, during the reign of ABBAS II. Several persons in Lahore, who contravened this order where subjected to the process called "tashhír," *i.e.*, riding on an ass with their face

* Balance due on abkárí (spirits), Rs. 20,136.

† Balance due on spirits, was RS. 2,650. (*See* under "Spirits" in the sequel).

‡ *See* BIRDWOOD'S Economic Products of Bombay, 211.

* Taken from BIRDWOOD, p. 211.

to the tail, and their visage blackened, this peculiar punishment being inflicted for infraction of imperial mandates! The "Makzan-ul-adwiyah" says it was introduced by the Portuguese from the New World (arz-i-jadíd). The common people then adopted a primitive method of smoking the plant, by making two holes in the ground, which were connected by any pipe they could get; in one the fire and tobacco were placed, and to the other the smoker lying or crouching down on the ground, applied his mouth and drew the smoke through the channel. After a time an improvement was effected by a piece of bamboo being inserted in the smoking hole, so as to enable the smoker to inhale the vapour without crouching down or bringing his mouth to the level of the ground.

The primitive form of huka is the naryel, a hollow cocoanut shell half filled with water. On one side of the shell is inserted a pipe,* which is connected with the fire pan and tobacco holder (chillam); and on the other side is inserted another tube, which goes into the mouth of the smoker; when the smoker draws, the smoke from the first pipe (the end of which is under water) is drawn up through the water, and thus cooled and purified.

After this naryel (which is still in use among Hindús) the huka was devised, being a much more elegant affair but on the same principle. It consists of a vase partly full of water, with tubes inserted into it, one of which joins the chillam or pipe-bowl, the end of this goes below the water, and the other tube is often connected with a long twisted pipe, called "necha pechwán," which ends in an amber mouth piece. The drawing pipe is always called "necha," and is often very prettily ornamented, silk and gold thread, being wound round and round the tube, which is made of sarkanda grass stems, &c.

The coil or flexible tube (necha) is made of a long coil of iron wire covered with cloth and ornamented; this was invented in AKBAR's time. Several "nechas" and hukas are figured in the annexed Plate.

A small huka, with a stiff "necha" of a peculiar curve is called "gurguri," the pipe is bent as in Fig. 1. The ordinary huka, with a stiff necha, has the latter only bent once at an obtuse angle, as in Fig. 2; this is called "changáni khamdár." A kind of huka, in which the smoking tube is not bent, but rises up straight out of the vase, and is called "sulfah" (Fig 3), is much used for smoking "charras." Another kind is called "kallyán," from the Arabic (ghaliyán).

In this, as in Fig. 4, the chillam tube is made of shisham wood carved all round with rings, and the "necha" made also of shisham wood, similarly adorned, comes out at the side of the huka and not at the mouth.

A huka for smoking "madhak" (opium), with a peculiar shaped chillam is called "madhaki."

In the Punjab the lower orders frequently smoke in companies, with one "hubble bubble" or naryel, or "kalli," which are the most ordinary and cheap forms. All sitting round in a ring, the pipe passes from one to another, each taking a few whiffs as it passes. This is never done by the higher orders, nor is it done in Hindústán. The "sulfah" form of huka is the commonest in Kábul and Peshawur.

The kinds of tobacco which are recognized are:—

1st. Called "Kandahár kakar;" this is of a yellowish light color, and has small indentations on the leaves like an *Onosma*; with this kind of tobacco molasses or "gurh" is not mixed; but as it tastes sweet, there is probably a small quantity of honey mixed with it previously; it is not twisted into any shape, but the broken leaf is left in little pieces. The stalk of the plant is used in this variety to make tobacco just as much as the leaves; in fact there is more stalk than leaves. Kakar tobacco is also grown at other places, and there is "Lahorí kakar," and "Shikárpúrí kakar," &c.

2nd. "Baghdádí;" the seed of this is very much sought after by cultivators, on account of the abundance of the produce; it is not imported from the place whose name it takes, but probably came originally from thence.

3rd. "Noki;" called from its pointed lanceolate leaves (of this there are two sorts, the *noki* and the *desi Panjábi*).

4th. "Sámblí;" this is a variety of which the leaves only are used, the woody stalk is of no use.

5th. "Zarda;" this is the best quality of tobacco, being of the kind called "noki."

6th. "Púrbi," from Hindústán, which is chewed with chunam, supári (areca nut) and catechu (kath); it is also smoked—but it is expensive.

7th. Baingani; this is very uncommon at Lahore; it is so called because its leaves are shaped like those of the baingan, or *Solanum melongena*.

8th. Súrati, from Surat and Bombay; this is rare; it is strong and bitter like "kakar."

The varieties of tobacco are easy distinguished by their appearance.*

* Sometimes this pipe is dispensed with, and the smoke sucked through a hole in the side of the shell. This is universally done in Thibet at the present day. I have seen it done in the Punjab, where a pipe was not at hand.

* For some of these particulars, I am indebted to DR. STEWART's Paper on Tobacco, in the Proceedings of the A. H. Society, Punjab, 1865.

The kakar is known by its small size, and the leaves are more round than the others, which have long pointed leaves; the leaves have also a long stalk, whereas in the other species the blade runs down the leaf stalk close up to, and even over, the main stem. The flowers are more decidedly campanulate, are of a greenish yellow, and never pink. This species (*N. rustica*) grows in Chota Lahaul, and the valley of the Chandra Bagha, and even up to Pangi. In ordinary sorts of tobacco the flowers and upper part of the stalk are always removed, as the gardeners say if this is not done the tobacco would be without flavor or strength. But the kakar is not so treated, and the whole plant, leaves, stalks, flowers and all, is made into tobacco. In Lahore, the kakar tobacco is generally later in ripening than the ordinary sorts; in Delhi it ripens 15 days earlier.

The *noki* tobacco has very large long pointed leaves: the other kind, called *desi*, is very similar in appearance, though stronger in flavor. The former is the same as the *kanir*, and the latter the same as the *gholar* of Hindústán. The leaves of the latter are not so broad or so accuminate as the former.

Baghdádi tobacco is not grown in Hindústán. This has the largest leaves of all, and the leaf is waved and thin; it is the mildest of all, and is smoked dry occasionally.

The tobacco is all prepared alike. On being cut down, the leaves (and in the case of kakar, the whole plants) are massed together in a pit after drying for a couple of days: they are covered with earth and left to ferment: when sufficient fermentation is accomplished, which is known by the earth sinking in at the top, the tobacco is removed. Of the common tobacco, the best leaves are removed and tied up in bundles (*gaddi*), the rest is twisted into ropes: the latter sells for a sixth or an eight less than the former. The kakar is never made into ropes.

The kakar has been introduced from down-country, it is said within 10 or 15 years past. The kakar of Peshawur and other places, called *Kandahári*, probably came from Kábul.

Its cultivation has been extended on account of the economy resulting from its use: it sells about a rupee a maund above common tobacco, but then it can be mixed up with it, and this makes the weaker sorts go much further: the whole plant also, and not only the leaf is utilized.

Dr. Stewart says all the other sorts are varieties of *N. tabacum*.

Every kind of tobacco is either "halka" or "phiká," that is weak or mild; and "kaurá," which is superior, strong and pungent. Tobacco buyers test the strength of tobacco by placing a bit on the tongue, and seeing whether it produces any irritation. Strong tobacco is heavier than mild.

Pure tobacco is called "sádá," but the common dealers mix up tobacco with molasses and sajji, and with the "gul," the cinder which comes out of the chillam after smoking, being ashes of the tobacco mixed with sugar; this is done to increase the weight.

Tobacco when twisted up like a rope is called "gaddi," and when the leaves are merely dried and pressed as they dry, it is called "kabbar;" the latter kind is generally the strongest.

A very highly elaborate kind of tobacco, called "*khamira*," is prepared for the rich. The compound consists of tobacco, apple preserved, gulkhand (conserve of roses), pánri,* (pán leaves dried), "muskhbálá" (a scented wood), and sandal wood, iláchí (cardamoms), kheora, the arak or essence of the flowers of *Pandanus odoratissimus* (comes from Ajmir and Mewár), "kokanber" wild jujubes, occasionally amaltás (*Cathartocarpus fistula*), (the interior of the seed pod). A cheap kind is made merely with sandal wood and wild bér fruit, gúgal (*Amyris agallocha*, gum), and sells as cheap as 7 seers per rupee. The real "khamíra" is sold by the jar-full, not by weight.

Tobacco is not smoked as in an European pipe, by lighting it and then removing the fire, but is put in the bowl or chillam, and the red charcoal is left in with it; the tobacco being mixed up with molasses and ashes, &c., burns very slowly. When tobacco is sold by the maund, the maund is equal to 52 seers; by custom it is also sold by what is called "ukka," that is so much for a certain superficies of the growing crop, as kanal or begah, &c.

Snuff is made of noki tobacco pounded; the best snuff comes from Kábul and Kandahár, and from Peshawur.

Native tobacco is very different in flavor from the Latakía, Cavendish, and other tobaccos in use among Europeans, which are much stronger.

The exhibited samples of tobacco are catalogued as follows:—

1011.—[3786-87]. Two qualities of tobacco. Municipal Committee.
Delhi.

1012.—[3810]. Tobaccos prepared in American method. Mr. Taylor.
Jalandhar.

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* In these places where pán is an expensive luxury, the leaf imported from Hindústán is preserved with great care. Day by day, as the leaf withers at the edges, the dying portions are cut off with scissors, and the shreds are preserved and dried as pánri.

Samples of honey-dew in cake and cut cavendish. Of these MR. TAYLOR writes: the tobacco I sent to the Exhibition at Lahore, was the result of an experiment made by myself to manufacture the common country leaf according to the American mode. I may also add, that the Tobacco Company I was in hope of getting up has not yet come into existence. I have, however, now some South American tobacco seed*, and hope soon to be able to produce something superior to which I sent to the Exhibition. Should this be the case, I have no doubt that sufficient support from the public to get up a regular Tobacco Company might be obtained.

1013.—Samples from Simla, and from the States—Bhaji (3800) and Kothár (3807); and a sample from Rámpúr of Basáhir(3823). MR. TER ARRATOON.

1014.—[3822]. "Tamáku talkh." Lahore. bitter, *i. e.*, strong, pungent tobacco. Tahsil Kasúr. TEHSILDAR OF KASUR.

1015.—[3824]. "Tamáku purbyá kakar" from Hindústán. MR. B. POWELL.

1016.—[3825]. Tamáku (a variety) MR. B. POWELL.

This was a variety from Kandahár, which is considered a very strong tobacco, and is smoked without mixing "gurh."

There is also in the jungles of Sharakpúr, and other parts, a plant called "gídar tamáku,"† a wild tobacco; it is not used as tobacco, but as a medicinal herb in hœmorrhoids and other cases.

1017.—[3819-21]. Three varieties were sent from Hushyarpúr, called tamáku, and tamáku dhatúra.

The third is not distinguished, it may be only an inferior quality.

Tobacco also was exhibited without specification of the variety, from—

* Some American seed from Kentucky and Ohio has been received and distributed; it has succeeded very well in some districts, and specimens of manufactured tobacco have been submitted to the A. H. Society.

† This name has already been mentioned as given to the Philipœa in the Shahpúr district: the plant shown here in Lahore under this name was not Philipœa, but an ordinary looking herbaceous plant.

Ambálah (3794); Gújrat (3847); price, Rs. 4 a maund.

Shahpúr, Khusháb (3852); Gugaira (3319).

Muzaffargarh (3854), where it sells for Rs. 5 a seer, grows easily, and produces fine plants.

Dera Ismail Khán (3860).

Dera Ghází Khán (3867).

Kapúrthalla (3878).

Kashmír, Srínagar (3884).

There is no sample of tobacco from Múltán, but I find in VIGNE'S travels (p. 22), the following notice. "There are from a thousand to fifteen hundred maunds of tobacco produced around Mooltan annually. The best, which, is called "surkh," or red, is sold for six annas, equal to about nine pence; inferior kinds are sold from four to two annas, a seer." The author of the Makhzan-ul-adwiyah mentions Multání as a kind of tobacco.

Tobacco in the form of snuff is exhibited from Muzaffargarh (3855), nasúr, "holás."

Dera Ghází Khán (3868-69), two varieties—one priced at 4 seers per rupee; the other 5.

Peshawur sends snuff.

Snuff is very little used by the inhabitants of the plains, but the Bilúchis and Hill tribes of the Deraját appear to use it more frequently. It is preserved in small egg-shaped boxes, with a little ivory stopper; some of them are very prettily carved out of the fruits of *Feronia elephantum*.

Tobacco is cultivated in almost every village, in rich good irrigated land abundantly manured, in the Cis-Sutlej States. MR. WYNYARD informs us, that tobacco usually follows the cotton crop. MAJOR (now GENL.) CLARKE writing of tobacco, in the Rechna Doab,* says:—"This plant is cultivated either on the "goera" lands, or preferentially on some highly-enriched plots of ground, such as are commonly found around villages. The seed is sown in the month Kattak, under the shade of the bér or sisoo tree, facing to the south, that it may have sun during the day, and yet be protected from night chills; as soon as it is sown it is covered with ashes; if a tree cannot be had, it is protected or sheltered from the north wind by any screen; the young plants are transplanted out in Mágh or Phágan; sometimes a part of the land ploughed for wheat is reserved for tobacco, or if not, the land is ploughed in Poh or Mágh, four or five times running, manuring it twice afterwards. The land cannot be too highly manured for this crop, which also requires three hand-hoeings and weedings; when blossoms appear they are all topped off to

* The Agriculture of the Rechna Doab, p. 6.

strengthen the plant; of course seed plants are excepted. After the plants are well above ground and have become strong, the crumbling alkaline earth generally found at the foot of old walls in ruinous buildings, is applied to the root of each plant, with a view to improve the quality of the produce.

"The crop ripens in Jeth or Har, according as the sowings may have been in Mágh or Phágun; it is watered fifteen times; before cutting the crop, it is essential to irrigate, for if cut when dry at the root, the produce will be worthless. The tobacco is left on the spot where it grew for one day after it is cut; on the second day the leaves are all turned, and they are collected and kept covered in some secure place, whence they are taken out on the fifth day; the leafy part is then separated from the stalks and coarse fibres, and twisted into hanks or rolls of from one to two seers. The cultivation of tobacco is rather troublesome; it brings a return of twelve maunds per acre. The labor for separating the stalks, &c., from the leafy part is paid for by two twists of the tobacco for each person, per diem."

1018 —[ ]. Bhang (*Cannabis sativa*, Willd.)

The products of the plant are the leaves dried and called "bhang;" the flower tops with their resin, called "ganja;" and the resin, from the seeds and flower tops, called charras (or *kirs* in Bukhára).

The plant is cultivated in almost every village, as may be judged from the large number of specimens that are exhibited, but only in small quantities for local consumption. Dr. Royle considers this the same plant as the fibre yielding hemp, which grows wild in the Himálayas, and which he says, "grows to a height of 10 to 12 feet."

Some have assigned this plant to another species, and called it *C. indica*, but without sufficient reason. It is difficult to say of what country the plant is a native. Willdenow says Persia; Gmelin says Tartary; while Thunberg found it in Japan. It appears of very wide distribution, being used by the Chinese, and called "mafuen, chatsar," (Ainslie). The Malays use it for smoking. The Turks using it for intoxicating purposes, call it *malach;* and even the Hottentots use it under the name of *docha*.

It must have been very easily introduced in Northern Europe, for Herodotus (Cl. 202) speaks of the Sythians as intoxicating themselves with it,—he says, that the "Scythians never wash any parts of their body except their heads, but then they fumigate themselves, and become intoxicated at the same time, in the following manner—they make holes in the ground in which they place heated stones, over these they erect a goat hair tent; and when the people to be fumigated have crept inside, the tent is closed over, and hemp seeds are flung on the hot stones. They soon send forth a virulent intoxicating smoke which fills the close tent, and the people inside being overpowered with the intoxicating effects, howl with excitement and delight." The Greek for this hemp is "kannabis;" the Arabic, kinab; Dutch, hennep; English, hemp, also "canvas."

The plant is solely cultivated in the plains for its "bhang." If cultivated for fibre, the crop requires thinning and tending so that the plant may shoot upwards into a tall plant and not bush or run to leaves and flowers, which is of course desirable when the plant is grown for the sake of the drug.

The dried leaves of bhang are sometimes smoked alone or mixed with tobacco; but the more common form of taking bhang is to make it up with flour into a cake, or a majún or sweetmeat which has a green color. There is also a common method for habitual drinkers of "banghi;" viz., of infusing the leaves in cold water in a pestle and mortar, and pouring off the clear liquor through a cloth strainer.

The eating of these sweetmeats by persons unaccustomed to them produces the most violent mania and excitement, and the eyes become red and inflamed.

I recollect at Lahore a case of attempted suicide by a youth, where it appeared he had purchased sweetmeats which contained bhang, of which he was not aware; he had not even taken bhang before. After a time he became almost frantic, rushing wildly about hither and thither, and at last threw himself into a well, whence he was fortunately rescued; after this he fell into a kind of heavy sleep or stupor and then recovered. Persons who are accustomed to the excitement of bhang are not usually so violently excited.

Ainslie describes "majún," as consisting of bhang leaves, milk, ghí, poppy seeds, dhatúra flowers, the powder of nux-vomica and sugar. He adds that an overdose of this has caused total derangement of intellect.*

The common majún to be met with in the bazars is often merely sugar, perhaps with ghí, and the bhang without the other ingredients.

1019.—[3831-38]. A complete series of bhang apparatus, from Lahore. Darogha Gori Shankar.

Consisting of bhang (the dried leaves), bhang seeds; chapatties made up with bhang; majún, a sweetmeat of thin flat pieces of sugar, flavored with and colored by bhang extract. There is also exhibited the earthen

* Materia Medica, II., 177.

pot or mortar (kunda) in which the drug bhang is placed with water, and a long wooden pestle (dandá) with which it is worked up; and the strainer (sáfá) with which the clear liquid infusion is strained off, when the bhang has been sufficiently infused in the pestle and mortar; the strainer consists of nothing but a small branch of a tree shaped like the letter Y, with two arms trimmed and smoothed, and a piece of fine cloth stretched between them.

Bhang was also sent from all the following districts, showing the prevalence of the cultivation and use of the herb.

Kangra (accompanied by the flower head, or ganja).
Gurgaon (3789).
Ambálah (3793).
Hushyarpúr (3814).
Gujranwalla (3841).
Rawalpindi (3844).
Gújrat (3845).
Shahpúr (3851).
Jhang (3853).
Gugaira (3317).
Muzaffargarh (3856).
Dera Ismael Khán (3859).

Dera Ghází Khán (3863-65). Three samples of bhang. The two latter samples, are sent both green and dry, being the bhang of the higher Sulaimáni hills. The Local Committee states that the action of this kind of bhang is so violent that it is completely stupefying and poisonous, and is not sold: ordinary bhang sells at 10 seers per rupee.

Bunnoo (Khost valley), (3870).
Hazara (3874).
Kapúrthalla (3877).
Kashmír, Ladákh (3879).
Jhínd (3886).

Bhang seed is sent from Ambálah (3795); Kanaithí (Simla States); and Lahore (3834).

1020.—Ganja, the flower head of the bhang, from Kangra, where it is used for smoking.

It is said also that when the bhang leaves are picked off and the stalks remain, the little knots which occur wherever a leaf issues from the stem, are picked off and collected as ganja; these contain much resin.

1021.—Charras (*Cannabis indica*).

The gum resin, exuding from the flower heads and also from the seed when ripe. When the seed is gathered, the heads are rubbed with the hands, and thus the charras is collected. In other places, men clothed with leather garments walk about among the hemp plants, brushing up against them. The gum resin comes off and adheres to the leathers, which are then taken off and carefully scraped.

The finest charras is produced in Yarkand and Káshgar. It forms an important article of export trade from Yarkand. About 3,000 maunds are annually taken to Lé, whence they are carried to the Punjab and Kashmír.

A small quantity, not above a few maunds, comes from Kandahár through the Bolan pass by the Shikarpúr traders. Through Afgánistán and Turkistán by Peshawur, about 75 maunds, at a value of Rs. 50 per maund, are imported from Samarkhand in Bukhára.*

There is a kind of charras called "garda" which is much in use, and of this again there are three sorts—"surkhá," "bhangra," and "khákí." When the bhang has been gathered and placed in a store-house, as soon as it is dry, persons go in with their faces covered with a thin cloth, which enables them to breathe without inhaling the dust which results from the process they perform. Next the heaps of dry bhang are covered over with a fine cloth, and the operators putting their hands under the cloth, begin stirring about the bhang, and making hay of it. Soon a fine dust flies out, and filling the room, settles down on the surface of the cloth spread over the heaps. When all the dust has been shaken out and settled on the cloth, the cloth is itself taken out and shaken: a dust falls down, which if of the best quality, and of a reddish color; this is collected and kneaded with a little water into a cake, and forms the best charras, which is called surkhá; more frequently the dirt that is shaken off is of a greenish tint, like the bhang itself, and this collected, forms "bhangra charras." Lastly, the powder which adheres to the cloths, and is scraped and shaken off, forms the worst kind, called khákí.

The specimens were few in number, those few being almost exclusively produced in the hills or else being imported—they were sent from

Lahaul (3815).
Spiti (3816).
Lahore, imported from Bukhára (3830
Lahore, imported from Yarkand (3836).
Dera Ghází Khán (3862).
Srinagar, Kashmír (3881).

1022.—Poppy (*Papaver somniferum*, L.)

The head or seed vessel (called post or kokwán) has two distinct uses. (1), While growing it yields, on being scarified, the milky juice, which when concreted, is called opium; (2), the fresh or dry heads, when in-

* Appendix XVIII., p. cxxv., Mr. Davies' Report on Trade Revenue.

fused in water, yield a liquor, which is narcotic and intoxicating. Opium is the most important product.

The manufacture of opium is not under restriction in the Punjab, as it is in Hindústán ; it merely ranks as a zabtí crop on which a certain cess is imposed. Most districts cultivate the poppy to a certain extent, and produce a small quantity, of indifferent opium for local consumption. Opium of superior quality is imported. This drug is however prepared in the Hill States, and the opium of Kúlú is of excellent quality, and forms a staple article of the trade of that region: it is also produced in Basáhir and Rámpúr, and at Doda Kashtwár, in the Jammú territory. It is secretly exported, concealed in goat skins, to Yarkand, Khutan, Aksú, and other Chinese provinces. Opium was interdicted in China in 1839 ; but the quantity smuggled in is considerable, and the officials on the road are bribed to connive. About 210 maunds* is the estimated quantity annually exported from Kúlú, Rámpúr of Basáhir, and Jammú. Persian opium is imported into the Chinese provinces through Bukhára, Khokán and Káshgár, but it does not reach the Punjab. Kúlú and other hill opiums are occasionally found in the bazars of the Punjab cities. The quantity of Kúlú and Rampúr opium exported is given as 150 maunds, selling at Yarkand for Rs. 99,000: from Kashtwár (Jammú), 60 maunds, selling for Rs. 39,600.

In the Punjab the cultivation of the poppy is thus described:—"Poppy is grown on manured land, a portion of the land ploughed for the rabi being kept for this purpose. When about to be made use of, the land is manured, ploughed ten or twelve times, and then levelled; after which it is divided into compartments or beds, and the seed having been previously steeped for two days in milk and water, mixed with some mustard seed and ashes, is then sown broadcast; the sowings take place in Assuh (Sept.-Octr.), and must be watered the two days following the sowing. When the young poppies are above ground, the mustard plants are removed in the process of hand-hoeing, then performed for freeing the roots. Ashes are daily strewed over the young crops. If the seed is without an admixture of mustard seed, it will not do well, and the crop will be bad. The process of band-hoeing, or loosening the earth at the root, is carefully continued, and the soil kept moist by timely irrigation, usually required every fourth or fifth day. The crop of post is ripe in Chét (March), when it is cut and piled up in the field. After drying some days in the sun the heads are plucked off. Great care is required to cultivate the poppy with success.

* Appendix XXIV. of DAVIES' Report, p. ccvi.

The time for extracting opium is in Chét, when the poppy has attained its full size. I may add, that a small flat iron tool, with two or three points, called a "nashtar," is used to scarify the poppy, being drawn longitudinally down the poppy head, so as to scratch it, whereon the milky juice exudes, which, after a certain time coagulates, and is scraped off with a small bent iron tool, like a miniature sickle.

ROYLE says (p. 66), that the poppy was probably introduced into India from Persia: this is likely enough; all the ordinary names for poppy and poppy seeds are Persian, and even the synonym in Sanskrit, "chása" and "apaynam," for poppy seed and opium, sound like corruptions of "*khash-khás*" and "*afyún*." There are two varieties, white and red, the latter appears to grow mostly in the hills. DR. ROYLE says he has seen it at an elevation of 7,000 feet, and mentions that he has no doubt the hill territories of N. W. India would perhaps prove the best of all opium growing districts, because most like the climate of Persia, where the best opium (called in the market, Turkey opium) grows. The superiority of Persian opium appears to be the excess of morphia it contains, which is said to amount to nearly three times more than Bengal opium; but DR. ROYLE gives the quantities which resulted from analysis by DR. SMYTHSON, then inspector of opium at Bombay, whereby it appeared that Turkey opium contained 6½ per cent. morphia; Malwa, 6 per cent; Bengal about 3 per cent.; but some fine Bareilly opium, 8½ per cent.

An accurate account of the manufacture of opium in India is foreign to a catalogue of Punjab products; but the reader will find much information in the Bengal Dispensatory, in the Pharmaceutical Journal, Vol. XI., p. 205, and in DRURY'S "Useful Plants of India," p. 339, *et seq.*

An account of the method of making opium, followed in Shahpúr and in Kúlú, will be found appended to the notice of the specimens.

Good opium is not perfectly soluble in water, and if a specimen dissolves, it is not a good kind; good opium is also inflammable, while bad kinds are not so. Some inferior kinds of opium are almost devoid of morphia. The following test is given in the New Edinburgh Pharmacopœia:—"A solution of 100 grains of fine opium macerated 24 hours in two liquid drams of water, filtered and strongly squeezed in a cloth, if treated with a cold solution of carbonate of soda in two waters, yields a precipitate, which weighs when dry, at least 10 grains, and dissolves entirely in a solution of oxalic acid."

Small doses of opium appear to be excitant and stimulant, but languor and sleepiness follow. In large doses it is a violent poison; by habit the effects of opium are diminished. The habitual use of the drug

produces effects like those of habitual drinking—tremors, paralysis, stupidity and general emaciation; its medicinal effects will be found under the head of opium, in the drug collection. As an intoxicant it is taken in little pills. People who take opium do so at regular times, and retire from life for the period; when they recover, they frequently take a draught of milk, which is a restorative.

An intoxicating liquor is formed by macerating or infusing the poppy heads with water, and sweetening with molasses; this is drunk by fakírs and others at festivals, &c.

Some writers refer the φαρμακον νηπενθες of HOMER to opium, but DR. ROYLE says it is very likely to be "charras."

Peganum harmala and *Lactuca virosa*, a kind of lettuce, are also said to possess narcotic properties like opium.

HONIGBERGER mentions that he gave lettuce opium to a opium eater, but that it did not affect him. (probably he had been too long acustomed to the stronger genuine opium to be effected by a weaker imitation).

Opium is prepared with a little "pán" or other aromatic substance, and made into small pills for placing in the chillam to smoke with, and is called "madhak."

Poppy heads or seed capsules were sent from the following districts:—

Gurgaon (3788).
Ambálah (3792).
Ludhiana (3796).
Jálandhar (3809). In Jálandhar poppies are grown only for the sake of the capsules, which are used in making "post," a poppy infusion: the plant is raised on ground which has had wheat on it: the produce is about 8 maunds an acre.
Kangra (3811).
Hushyarpúr (3818).
Lahore (3826).
Gujranwalla (3840).
Rawalpindi (3843).
Muzaffargarh (3857).
Kapúrthalla (3875).
Srínagar, Kashmír (3883).
Jhind (3885).
Simla (3801-02), Mahlog.
Múltán. The Múltán poppies are remarkably large, and the Kangra variety (3811) uncommonly small in size.

The collection included a number of samples of poppy seed, which hardly ranks as an intoxicating drug, but is chiefly used as an oil seed.

Simla, Bhají (3798), Balsan (3806).
Lahore (3835).
Shahpúr (3848).
Bukkur (Shahpúr), (3850).
Dera Ghází Khán (3866).
Peshawur (3871).

The samples of opium were:—

Lahore. **1023.**—[3827-29]. Three qualities of opium.

1*st.* "Afím pukhta." Opium purified by boiling and straining.

2*nd.* "Afyún paharí" or "kachkará," from the Hills (Kúlú, Simla, &c.)

3*rd.* "Afyún," from Shahpúr.

The following districts also sent samples:—

Ambálah (3791).
Simla States as follows:—
Jubal (3797).
Bhaji (3799).
Sirmúr (3803).
Kothí 3804.
Kúlú (3812).
Gujranwalla (3839).
Rawalpindi (3842).
Gujrát (3846).
Shahpúr (3849).
Muzaffargarh (3858).
Dera Ghází Khán (3861).
Kapúrthalla (3876).
Srínagar, Kashmír (3882).

1024.—[3840]. Opium, from Shahpúr.

A bígah of land intended for poppy cultivation is first ploughed eight times, and then the land is divided off into beds ("kyárah"): on these they throw 100 donkey loads ("borah") of manure. They then take half a seer of poppy seeds, and mix it with 2½ seers of sand or fine earth, to ensure equal distribution of the seed, and sprinkle it over the prepared land; this is done in Kátak (October). After sowing, the land is irrigated, and this is continued every fourth or sixth day as may be necessary. After the third irrigation the young plants appear. A week after this the crop is weeded carefully, and if necessary, thinned by removing superfluous plants: it is again weeded after the interval of another week, and if any place in the field appears to have produced sickly plants, (which are known by their pale yellowish color,) ashes and manure, are added by hand, to encourage the growth. In Chét (April) when the crop is nearly ripe, the Khatris buy the crops as they stand. The price obtained varies from 20 to 60 rupees an acre, according to quality and the price current of opium at the time of sale—these are the limits within which prices have ranged in this district for many years past.

Extraction of the drug—The drug is extracted

by making incisions on the capsules with a three-bladed lancet, called nashtar. The incisions are made vertically, about half an inch in length, three strokes being made with the instrument each time, making nine cuts in all; and this is repeated four times after intervals of four days, making 36 incisions in all. The whole operation thus extends over about 13 days. The cuttings of the capsules are made during the middle of the day, as it is found that the heat assists the exudation of the juice. The morning after these incisions, the juice which has exuded (and which is then of a bright crimson color) is scraped off with shells (the river mussel), and collected in cups made of the leaves of the plant itself.

The workmen do not touch the juice with their hands. When they have collected the shell-full of opium juice, they empty the shells together into a vessel, and leave it to dry still further. When dry they form it into balls ("tiká") about 6 or 8 chitacks (nearly 1 lb). weight, and place it in the shade; those balls are turned every second or third day till they are dry, and these form the opium in use.

Cost of extraction.—It is estimated that one man (women and children are not much employed in this work here as in other districts) can, on an average, incise the capsules and collect the juice of about 10 murlas of the crop. This operation is repeated four times. The laborers are paid in cash, at from 2 to 4 annas per diem, the rates varying according as a larger or smaller area is under cultivation. The cost, therefore, of extraction, varies for 4 to 8 rupees a beegah, or 8 to 16 rupees an acre. The laborers chiefly employed on this work are men of the Arora caste.

The produce of an acre varies from 4 to 8 seers; the selling price from 7 to 12 rupees per seer. In the process of drying the extract loses a fourth of its weight.

The poppy seeds, called "khash khás," are collected and sold—an acre yields from 20 to 30 seers, selling at that same rate per rupee—one-third goes to the laborer for his hire. The seed therefore brings the proprietor of the crop in about 10 annas. It is used for making oil, and the oil is employed principally in the manufacture of soap. In some districts the dry poppy heads are sold for making an intoxicating infusion. Here they possess no such value, and are thrown away.

1025.—[3812]. Opium, from Kúlú.

Of the cultivation of the poppy in Kúlú, the following account has been received from the Deputy Commissioner of Kangra.

Irrigated land is never used in this district for cultivation of the poppy, nor is canal water given to assist the first germination of the seeds except as a last resource in a droughty season; rain water is considered better for the plants. The ground is ploughed from October 15th to end of November twice, once to kill the weeds and once to soften the soil for sowing. 100 maunds per acre of animal manure should be ploughed in. Three seers of seed per acre is mixed with 6 seers of fine earth, and sown broad cast. There are two kinds of seed, white and black. The former produces white flowers and is most used; the latter, rose, crimson and purple flowers. The seed will neither germinate nor spoil until rain comes, though it waits three months for it, and the plants will be above ground in a week after rain. Every month the ground is weeded twice, and plants gradually thinned so as to leave them a yard apart. 5 maunds of fresh manure an acre should be added during weeding.

The plants flower in March, and the heads ripen in May and June. In the Hushyarpúr district these dates are a month earlier. Ten days before the heads are ripe, they are scratched in the evening with the "sernoo" or razor (in some places with needles tied together), and in the morning the congealed juice is scraped off with the "tosnoo," a wooden knife; so again after four days, and again after four days further interval. The best heads, destined to yield seed, are spared from this tapping.

There are probably rather above 200 good plants in an acre, which yield rather under 1½ máshas of opium each, or 3¼ seers pucka in all. The collectors put ghi on their fingers, or more often spit upon them to prevent it sticking, and roll up the produce in balls in poppy leaves; no other leaf will do. The remainder of the plant is burnt and ploughed in, and the field immediately sown with maize or any other summer crop.

The expenses, independent of rent and profits, may be as follows on an acre:—

3 seers seed, ...	0	2	0
Ploughing, ...	1	8	0
Weeding, ...	3	0	0
Manufacture, ...	3	0	0
Total expenses, ..	7	10	0
3¼ seers opium, ...	15	0	0
2¼ maunds seed, ...	4	0	0
Total receipts, ..	19	0	0
	7	10	0
Profits, ..	11	6	0

Opium improves with age for many years.

Opium is one of the staple articles of trade of Kúlú

and Yarkand. It is an article of great consumption among the Chinese army and gentry; being a luxury and necessary of life with them, as tea is with Kashmíris. The Chinese smoke it in pipes, and do not swallow it down as other nations do.

There has been a gradual increase in the Chinese trade within the last fifteen years, when it revived after the prohibition of 1839. The police establishment posted at the chokees of Kokiar and Killian, on the route between Yarkand and Lé, are bribed to connive at the unauthorized export.

About 210 maunds is the estimated quantity annually exported from Kúlú, Rámpúr (Basáhir), and Kishtwár, in the Jammú territory, all goes to Yarkand. A much larger quantity of Persian opium is believed to be imported into Turkish China, through Bukhára, Khokán and Káshgar.

The annual export from Kúlú is about 100 maunds.

1026.—Dhatúra (*Dhatura alba*), thorn apple.

1027.—[3790]. Dhatúra (dried plant). Rohtak. Lieut.-Colonel Royle.

1028.—Series illustrating dhatúra as prepared for a poisoning agent. Lahore Museum.

The series consists of the seeds of the plant in their raw state; seeds roasted; essence of the seeds; atta (flour) drugged with the poison; sugar do.; and tobacco do.

The plant is familiar to most people by its beautiful long white flowers, which in Rohtak are used as an offering to the shrines of certain idols. But the dhatúra has attained a worse celebrity as being the agent used by the "Thugs" to stupify their victims.

Both kinds of the *Dhatúra*, the white and the purple are used, but the white is considered the most efficient. The drug has its medicinal uses, and its value as a curative in asthma, is known both to Europeans and Natives, who smoke the seed in their hukas when so afflicted.

For poisoning purposes the seeds are parched, and reduced to a fine powder; thus it is easily mixed with sugar, atta, tobacco, &c. Also the professionals distil the seeds with water, forming a powerful essence: ten drops of this is sufficient if put into a chillam of the "huka" to render a man insensible for two days.

The taste is acrid and bitter, and soon followed by a burning suffocating sensation. It is very difficult to detect in a *post mortem* examination.

The victims are usually discovered in a state of insensibility, and breathing hard and heavily: if removed, care should be taken not to expose them to the heat of the sun, which is fatal. The action of the poison is quicker in the hot weather than in the cold: much of course depends on the individual constitution of the victim, but usually in hot weather it begins to work in five minutes, and coma supervenes within the hour. In cold weather it begins to act in a quarter of an hour or twenty minutes.*

* These particulars are obtained from a Circular, No. 125 of 1863, from Assistant General Superintendent Oudh and N. W. Provinces; a copy of which was sent, together with specimens, to the Lahore Museum by Major Chamberlain.

SUB-CLASS (F). SPICES.

The class is not a very extensive one; nor are its samples in any way remarkable.

The ordinary spices exhibited are cultivated more or less in every district, while the finer ones—mace, nutmeg, cloves and cinnamon (jauntari, jaíphal, karanful or laung, and dárchíní), are mostly imported from Bombay; so are also black pepper (káli mirch), cardamoms, great and small (bari and chote iláchí), but these two latter articles are also imported from Hindústán. The masticatory areca nuts and pán (*Chavica betel*) are brought up from Bengal and Hindústán. Spices to a small amount form one of the articles of import that come to the Punjab from Karáchí.

Besides these, there are two roots of some value, the best being hill produce, viz., ginger and turmeric: the latter acts both as a spice and condiment, giving the yellow color to curries, and is used also as a dye stuff. Spices, and especially red pepper, are considerably used by natives, as their ordinarily flavorless, farinaceous and pulse diets, demand the addition of a stimulant. When meat is used, it is generally not as the substance of the meal, but as a relish, in which case it is often cooked with spices and flavoring substances. Spices are much esteemed in medicine; every one in this catalogue may be found in the native pharmacopœia, with special virtues attributed to it. Besides "pán and areca" (pán supárí), which are not very common in the Punjab (on account of the difficulty of obtaining them), cardamoms and other spices are constantly chewed by the people.

The specimens exhibited were as follows:—

GINGER.

1029.—(*Zinziber officinale, Amomum zinziber, L*). Synonyms—Zanzabíl, sońth (dried ginger), adrak, ádá (Sanskrit, "sringavera," which Royle considers to be the origin of the other names). Persian "shangvíz."

Dr. Royle mentions that the cultivation of ginger and also of turmeric extends in the Himálayas to an elevation of 4,500 feet. The ginger of the Kangra hills is different from that of Simla. Ginger is brought down from these hills in considerable quantities. When dried in the sun, it is called sońth; its use as a spice, as a stomachic and stimulant, is universal: it enters into various compositions of pickle and preserve.

The following specimens were exhibited:—

Simla States—Dhámí (2777), Bhaji (3902), (fresh ginger), Kothar (3903), Mahlog (3904), Sirmúr (3906), Baghal (3910).

The following account of the cultivation of ginger has been received from the Hill States adjoining the Ambálah district. Ginger is principally produced in Matúr, Másá, Patrá, Dárná, Kothí, Kotahi, Bágal, and Jayál. The best pieces of last year's harvest are selected, and placed in the corner of a house, in the month Phágan; the heap is then smeared over and covered with cowdung to keep the roots from drying up. In Hár month, when the first rain falls, they plough up the land two or three times. They divide off the land into beds with a little raised edge round each bed, taking care to make openings to let superfluous water run off, for if water stands on the crop, the roots will rot. They then bury little pieces of the roots, 3 inches deep in the soil, at intervals of 9 inches: they next cover over the field with the leaves of trees, which keeps the soil moist, and over the leaves they spread manure, to a depth of half an inch. When it rains the water impregnated with manure filters readily through the leaves to the roots. Artificial irrigation is not employed while the rains last, but from Assuh to Poh it is necessary. In the month Poh the plants are about 2 feet high, for every one shoot there are eight tubers or parts of the root—these are dug out, and buried in another place for a month; then they are taken out, exposed to the sun for a day, and are then fit for use. In the months of Sawáń, Bhadon and Assúh, three times, the field is weeded. A begah of

land requires 8 maunds of ginger to plant it, and yields 32 maunds for a first rate crop.

Ginger fit for planting again sells at 8 to 10 seers per rupee; that for use only, at 24 seers to 32 per rupee.

In order to dry ginger into "sonth," the fresh roots are put into a basket which is suspended by a rope, and then two men, one on each side, pull it to and fro between them by a bit of rope attached, and thus shake the roots in the basket; this process is carried on for two hours every day for three days. After this, the roots are dried in the sun for eight days, and again shaken in the basket. The object of the shaking together is to take off the outer scales and skin of the root. A two days further drying completes the process, and sonth sells 3 seers to 4 seers per rupee.

Turmeric is cultivated in the same manner, when ready it is dug up, steeped in hot water a day and a night, and then dried.

Mr. Melville, in his Settlement Report, further informs us that, ginger is of two sorts—"ghár," or close grained; "fálsar" or fibrous. It is a most valuable crop: it is calculated that 7½ maunds go to sow a kucha begah. The average produce is 30 maunds. The green ginger (adrak) sells at 1 rupee a kucha maund, so that you have Rs. 22 produce after deducting the next year's seed. This gives Rs. 88 for a pucka begah, two-fifths of this would be Rs. 36, and if you deduct a third from this, there would still be, as the "Hakim's" share, Rs. 24 per pucka begah.

1030.—[3913]. (Adrak), from Kangra.

Ginger in the Kangra district is thus noticed by Barnes, in his Report:—

Ginger is cultivated across the Beás in talúquas Seeba and Chinore, of perganah Haripúr. It is a different species from the ginger of the Simla hills. The root is smaller, the color red, and the fibre delicate and palatable.

A sample also was sent from Hushyarpúr (3924).

TURMERIC.

1031.—(*Curcuma longa*, Roxb). Haldí, Zardchob (Pers.)

Tumeric or "terra merita," has two uses—as a condiment and as a dye—the kinds, however, that are best suited for dyeing are not so good for eating, and *vice versâ*.

There are several varieties, called "púrbi" (from Hindústán), "pahárí" (hill turmeric); besides these Royle mentions "moela" haldi and "jowala" haldi, which latter kinds are best for dyeing purposes. The name "amba haldi" is also applied to the dyers' turmeric.*

Turmeric is grown like ginger, from cuttings or sets which are little pieces of the fresh root cut up and planted.

Turmeric is supposed when fresh to be anthelmintic, and always to be cordial and stomachic; the root is applied to recent wounds and bruises, and the powder of the dry root is considered a good application to cleanse foul ulcers.

The specimens were as follows:—

Simla States—Jabal (4471), Bhaji (4473), Bágal (4474), Baghat (4475), Dhámí (2778); Kangra (3914).

In the Kangra district turmeric is reared in parts of Nadaun, Harípúr and Núrpúr. It is cultivated on low moist soils and requires much care and manure. It is planted in May, and is not matured till the end of November. The tubers are then taken up and dried, partly by the action of the fire and partly by exposure to the sun. It is considered quite as remunerative a crop as sugar, and has this advantage, that it occupies the soil only six months. These few localities supply turmeric for the consumption of the whole district.†

Samples were also sent from Hushyarpúr (3923); Kapúrthalla (3959); Jálandhar (4480); and Kashmír, Jammú (3964).

In connection with this species of *Curcuma*, I take occasion to include several others which, though used more as medicines than as condiments, yet from their botanical affinity and aromatic and fragrant properties, seem suitable for mention; such are the following:—

KACHUR.

1032.—[3932]. (*Curcuma zerumbet*, Roxb.), kachúr, zarmbád. Lahore bazar.

The kind called "pahárí kachúr" (*Curcuma kachoora*) is noticed by Royle as being more like *C. montana* than *C. zerumbet*.

This is planted in April, and the root is ready for use in November. The roots are scalded in boiling water, and then shaken in baskets till the fibril and

* It is remarkable, as noticed by Royle, that in the "Tuhfat-ul-Múmínín," the description given by Dioscorides of Chelidonium majus—(Greek, χελιδόνιον το μεγα) is translated and applied as the description of turmeric, the Greek name of which is erroneously given as "khaldoonion to magha." In the "Makhsan-ul-Adwiya," this erroneous Greek name is also given, but the description is correct. *See* Royle's Illustrations, p. 358.

† Barnes' Settlement Report of the Kangra District.

outer skin are rubbed off.* In Kangra we have the following account of kachúr.

It is grown over the whole district, but in very small quantities, as its uses are limited. The root is a pale yellow, warm and aromatic like turmeric, but bitter. It is given as a carminative medicine internally, and applied on the skin as a plaster to remove pains. The powder made of the dry root is used by natives in the Húlí festival; a third variety is grown simply for the black round seed it produces, which are strung together and sold for necklaces at the Jawálá mukhí fair. This species is called "Sudarshan"† *(Hedychium coccineum)*. *Amaryllis grandiflora* is also called sukhdarsan. I found the kachúr root one of the ingredients supplied by the Lahore druggists for scenting oils.

The name kachúr is given in JAMESON'S Catalogue, 1854, to both *Zinziber elatum* and *Curcuma longa*.

Closely allied to the "kachúr" is the jadwár, or nirbisi (nírvisha), that is referred to zedoary *(Curcuma zedoaria,* Roxb.*)* This is also called "ban haldi," and "ambi haldi."

Some have supposed this to be the *long zedoary* of the shops, but the point is doubtful. ROXBURGH supposed that the short zedoary was not another species, but merely the long zedoary roots cut and pared.

In DRURY'S "Useful Plants," ambi haldi and ban haldi are referred to a species *Curcuma aromatica*, Salisb., identical with ROXBURGH'S *C. zedoaria*, the species *C. zerumbet* not being recognized. Kachúr is placed under *C. zedoaria* of ROSCOE.

AINSLIE (I., 490) makes the "round zedoary" to be the *Kæmpheria rotunda (Zedoaria rotunda* of BAUHIN), the "long zedoary," jadwár, nirbisi, to be *Curcuma zedoaria*, Roxb. *(C. aromatica,* Salisb.*)*, and the "kachúr," to be *C. zerumbet* of ROXBURGH. ROXBURGH refers the zedoary of English druggists to his *C. zerumbet*, thus identifying it with kachúr, and says, that this is the long zedoary.

The round zedoary is called by ROXBURGH *C. zedoaria*.

It seems pretty clear that there is a distinction between round and long zedoary, since the best zedoary comes from *Ceylon*. Now *C. zerumbet* grows in Ceylon; as does also *Kæmpheria rotunda*, which latter plant is called in Singhalese *san kenda*.‡ The plant has purple and white flowers, appearing in March or April, leaves radicle, oblong, no stem, root biennial.

* Illustrations of Himalayan Botany, p. 359.

† BARNES' Settlement Report.

‡ ROXBURGH'S Flora Indica, I., 15.

The best variety of that zedoary called nirbisi or jadwár does not come from Ceylon but from Naipál, whence it is imported into Lé, to the extent of about 3 or 4 maunds a year. Of this quantity about 20 seers go to Yarkand, and the rest to Kashmir and the Punjab. At Lé its value is about Rs. 5 to 15 a seer, but picked specimens are worth their weight in silver; and at Yarkand, the finest sell for double that price.

This plant is described as a great beauty, having its flowers in large tufted rosy spikes rising from the ground, leaves broadly lanceolate, entire, the root, biennial and tuberous. Hence there must be a difference between this nirbisi zedoary and that kind which is extolled as the produce of Ceylon.

With regard to nirbisi, natives say that it grows where "bish" or aconite the poison does, and that it is a remarkable provision of nature that where the "bish," a poisonous root grows, there also should be found another (zedoary) which is an antidote to it; and so they call the latter root nir-bishi, the "antipoisonous."

1033.—Kapúr kachri *(Hedychium spicatum)*.

The roots are pounded up with tobacco and smoked.

CARDAMOMS.

1034.—*(Elettaria cardamomum)*, iláchí.

The botanical name given is ascribed to the small white cardamoms "choti iláchi," which have black seeds inside and are commonly chewed; it is the custom to offer these to visitors in native houses.

There is also the variety called "barí iláchí." These latter have nine winged capsules, the skin is rough and brown instead of smoothly striated and white as in the small ones; they are used in cooking and to make "arak" or essence in medicine, but are not eaten. This variety is the produce of *Amomum maximum* Roxb., or ROXBURGH'S *Alpinia cardamomum*, the middle sized cardamoms, which are called in Bengal "do-keswa," or Bengal cardamoms. ROYLE mentions that *A. sericeum* is also called "doi-keshwa."

AINSLIE ascribes his "barí iláchi" to *A. granum paradisi* of Linnaeus.

There are many varieties of cardamoms known to commerce, though not in this province; such are the Sumatra or cluster cardamoms, Madagascar cardamoms, grains of Paradise, Meleguetta pepper, and the "moráng iláchí" of the Eastern frontier of

* DAVIES' Report, Appendix XXIV., page ccxxxviii.

Bengal (*A. aromaticum*); also the rough fruited cardamom (*A. villosum*), and a Silhet bari iláchí (*A. dealbatum*). The varieties differ chiefly in size, in color, and in the markings and divisions of the seed capsules. The *Elettaria* is abundant in the hills along the Malabar coast, and the fruit is largely imported into the Punjab from Bombay. The fruit is accounted carminative and stomachic.

In Travancore, where quantities of cardamoms are produced, the plant grows wild in the higher hills, and the cultivators merely clear a portion of the woody hill side of its trees, just before the June rains; after three months the cardamom plant springs up of itself. The plant grows to its full height in four years, and if cut down the stumps sprout again and yield fruit.

CORIANDER.

1035.—(*Coriandrum sativum*). Synonyms—Dhanyáñ; kashníz (Pers.).

This seed, or more properly fruit (for this spice consists of the whole, small, round fruit, and is not the seed contained in the centre of a capsule), is like the last in its properties, carminative and stomachic. It is much used in curries and for flavoring spirits, as well as in medicine. There is a strong flavored essential oil obtainable from it.

It is not unfrequently cultivated in the Punjab. Specimens were sent from Ambálah (3895); Simla States—Bhaji (3898), Balsan (3909); Jálandhar (3912); Kangra (3916); Hushyarpúr (3921); Lahore (tahsil Chúnian), (3931); Gujranwalla (3937); Shahpúr (3940); Gugaira (3321); Muzaffargarh (3945); Dera Ghází Khán (3946); Bunnoo (3950); Peshawur (3955); Kapúrthalla (3958), Jhínd (3965).

CUMMIN SEED.

1036.—(*Cuminum officinale*), zíra safed.

Specimens were sent from Delhi (3887); Gurgaon (3891); Simla, Basáhir (3908); Rawalpindi (3938); Peshawur (3951); Hazara (Kághán), (3956); Kapúrthalla (3961); Kashmír (3963).

BLACK CUMMIN.

1037.—(*Cuminum cyminum*), zíra síya. Synonyms—Shauníz (Arab.); siah dána (Pers.) In Egypt it is called hab síndí (Indian seeds).

This is called black cummin; it is very common in the hills. Dr. Cleghorn mentions it at Kanáwar as an article of trade, selling for 6 seers to the rupee.

Some of the "kálá ziras" are called carraway seeds or *Carum nigrum*, which latter name is also applied, but not definitely, to the Kanáwar produce by Dr. Royle. (Illustrations, p. 229). *Nigella sativa* is also called kálá zíra, and *Vernonia anthelmintica*, kalí zírí.

Specimens were exhibited from Gurgaon (Palwal), (3892); Kangra (3917); Lahore (3929); Bunnoo (Khost valley), (3949).

ANISE.

1038.—(*Pimpinella anisum*), anisún.

From Gurgaon (Jhársah), (3890); Bhaji (Simla), (3899); Mahlog (Simla), (3905); Peshawur (3952); Kangra (3915); Lahore (3930).

AJWAIN.

1039.—(*Ptychotis ajwain*).

From Delhi (3889); Balsan (Simla), (3911); Shahpúr (3939); Gugaira (3322); Muzaffargarh (3943); Peshawur (3953).

DRIED MINT.

1040.—(*Mentha sativa*), pudína.

Is more commonly used by Europeans than natives, but is esteemed as a medicine by the latter.

Samples were sent from Ambálah (3897); Hushyarpúr (3922).

MUSTARD SEED.

1041.—(*Sinapis ramosa*), "rai."

Samples were exhibited from Gujranwalla (3935); Sirsa (3893); Ambálah (3896).

This is the best kind of mustard seed (white seed). It is, however, inferior to Durham and other European mustards. The number of samples of mustard both black and white varieties, is very great under head of oil seeds; and it is principally produced for the sake of the oil. Natives do not use mustard powder mixed into a paste for a condiment as Europeans do, but they add mustard seed to curries and chutnies, or occasionally to pickles. They also pound the seed and mix it with oil or water, and spread it over pieces of vegetables which they intend to pickle, and then leave them to ferment till they are acid.

CHILLI.

1042.—(*Capsicum frutescens*), red pepper, lál mirch.

This is very extensively used by natives, both pickled and boiled up with their pulse, &c. Their

insipid farinaceous diet requires much more of this kind of condiment than an European diet does.

A sample of the fruit, both as a pickle and as a conserve with sugar, was exhibited from Lahore. Natives do not usually reduce it to powder for "cayenne pepper," as Europeans do.

There is considerable variety in the size of the capsicums exhibited, leading to the opinion that there may be several species.

There is a small round fruit from Lahore. This may be the species called *C. minimum*, called in Hindústání (so says AINSLIE) dhánmirch. Again, the Shahpúr sample is of remarkably long and large fruits.

The recognized species are *C. annuum*, *C. baccatum* (bird pepper), *C. grossum*, the large round kind, often seen in pickles (I have gathered enormous specimens, almost as large as an apple, at Malta), *C. frutescens* (the commonest, known by its shrubby growth, *C. annuum* is herbaceous), *C. minimum* (BLANCO), *C. nepalensis* (DR. OWEN), and *C. purpureum*. Besides these there are many less common varieties belonging to various countries, *C. pyramidale*, *conoides*, &c., &c.

Red pepper is esteemed in medicine as a gargle for faucal ulcers, as a liniment for paralytic limbs, as a general stomachic and stimulant. (AINSLIE).

The exhibited samples were from—Ambálah (3894); Bhají (Simla), (3960); Sirmúr (3906); Hushyarpúr (3920); Lahore, chillies (3927); round chillies (Kasúr tahsil), (3928); Gujranwalla (3936); Shahpúr (Uchálí), very large capsicums (3941); Dera Ghází Khán (3947-48), two varieties; Gugairá (3320); Dera Ismail Khán (3377); Kapúrthalla (3960).

CINNAMON BARK.

1043.—[3957]. Dárchíní; taj. Bakót, Hazara. DEPUTY COMMISSIONER.

This is a cassia cinnamon produced by *Cinnamomum albiflorum*, or some allied species. It is not the genuine Ceylon cinnamon of commerce (*C. zeylanicum*). DR. BIRDWOOD observes:* "It is remarkable that while the Indo-German races prefer *Cinnamon*, the Mongolian races prefer *Cassia lignea*, the more refined bark being unsaleable amongst the latter." HERODOTUS, in speaking of the spices, (iii. C. 111,) distinguishes between cinnamon and cassia. Cinnamon is by no means common at Bakót; the sample exhibited was of the same color as ordinary cinnamon, and had a pleasant taste. Genuine cinnamon is imported by Calcutta and Bombay.

TEJPAT.

1044.—(*Cinnamomum tamala*), tamálpatr.

TEZBAL.

1045.—(*Cinnamomum albiflorum*). Lahore bazar.

Much used as a flavoring aromatic substance as bay leaves are in Europe. It grows very largely in Kumaon.

NUTMEG.

1046.—(*Myristicha moschata*), jaiphal. Jauz-ut-tríb (Arab). Lahore bazar.

Imported *viâ* Calcutta and Bombay.

MACE.

1047.—" Jauntari."

The aril of the foregoing fruit is called mace: it is red when fresh picked but dries tawny yellow. It is imported from Bombay and Calcutta.

CLOVES.

1048.—(*Eugenia caryophyllata*). Synonyms—Laung, karanfal.

The dried unexpanded flower buds. Its use is well known.

ARECA NUT.

1049.—(*Arecha catechu*). Amritsar bazar. LOCAL COMMITTEE.

The sample box contained whole betel nuts and also nuts sliced up ready to form ingredients with the little triangular packet of pán leaf and betel, which is made up to be chewed as a masticatory. The practice of chewing is not very universal, though no doubt it will largely increase when the railway opens up to Amritsar, thus facilitating the export of leaves of the pán. As it is, betel nuts are largely imported, and the pán leaves are brought up most carefully packed by traders, who are solely occupied in this business. The real Chavica plant will not grow in these provinces, though there is some kind of substitute which is occasionally cultivated and called pahárí pán. The real pán is brought up from the nearest locality where it will grow. The leaves are packed and kept moist; the trader watches and inspects his leaves with the utmost care; as soon as the edge begins to show

* Economic Products of Bombay, p. 73.

symptoms of decay, he carefully cuts away with a pair of scissors the dying portion, and then re-packs them. The leaves are of a smooth, rather thick and even succulent texture: they keep fresh some time, even after being clipped and clipped in the manner described, till but little of the shape of the original leaf remains. The shreds so cut off are not wasted, they are collected and dried into "*pánrí*," which is mixed with tobacco, &c.

The leaves and nut are prepared with chunam and cardamoms, just as in Bengal. They are offered on taking leave at a visit of ceremony.

Ceylon is a locality producing areca nuts in abundance, but Travancore appears to be the great place. In that province there are over a million trees, producing each from two to three hundred nuts a year, and sometimes more. The nuts ripen in November, but are often gathered in July and August; the husk in which the nuts are enclosed are removed, they are then boiled till soft, and taken out and sliced: the water in which they were boiled turns red and starch-like, being impregnated with the catechu an astringent principle; this is inspissated and rubbed on to the slices of the nut, which are then dried in the sun and become of a black color. The nuts however, that come to the Punjab are generally entire, and without having been boiled. When the nuts are treated to produce the catechu of commerce, they are boiled in water, which becomes discolored and thick: when this is inspissated and dried, and it forms "kossa," the catechu of the greatest astringency; but the best catechu, of a red or brown hue, is derived from the second boiling of the nuts; when the first boiling is accomplished, the nuts are removed and boiled in fresh water, which is then inspissated as before. There is a wild species of an areca (*A. Dickensonii*) which grows commonly in Travancore—the nuts are used by the poorer classes.

The *Chavica betel* or "pán," is cultivated extensively in Bengal in moist rich soil, the gardens being completely covered over at the sides, and all over the surface with mats of grass or reeds to protect the plants from the dews and from the sun. The effects of this leaf are described as stimulant to the salivary glands and digestive organs. The leaf and nut when chewed discolour the teeth much, imparting to them a red color; but natives assert that the gums become strengthened and the teeth fixed by the use of this article; the flavor is strongly astringent, pungent, but not otherwise unpleasant.

SAFFRON.

1050.—[3962]. *(Crocus sativus)*, záfrán; kesar (Hind.) Srínagar. H. H. THE MAHARAJA.

1051.—A fine sample of Kashmír saffron. Lahore. PANDIT MANPHUL, E. A. C.

The Arabic name of this plant is "karkam," which has been converted into the name "Curcuma," and applied to turmeric. It is stated that the species is indigenous to Kashmír and also to Persia where it has been, and is, largely cultivated.

It has been naturalized in Western Europe and in England, and we have a town called "Saffron Walden."

This is used by natives in confectionery as it is in Europe; and we must confess, in spite of DR. BIRDWOOD* (who considers the use of this spice as "an evidence of uncleanliness and low taste"), that neither the flavor of saffron in moderation is disagreeable, nor the odour offensive.

As a dyeing agent it is very little in use.

Saffron is prepared for the market in two ways, either the stigmata of the flower are compressed and dried into cakes, in which state they form cake saffron, or else they are dried loose and separate, when they form the hay saffron.

DR. ROYLE states that the former kind is usually prepared in Persia and bears the higher price, and that hay saffron is made in Kashmír. I have never seen any cake saffron from the latter place, and believe that it is not made there.

It is a considerable article of trade, both East and West; it is esteemed medicinal in the East, with all sorts of virtues ascribed to it.†

In European practice it is still regarded as stimulant and antispasmodic; it is not a very powerful medicine, but it appears that dogs have been killed by giving them a very strong infusion of it.

A sample of saffron is sent from Dera Ismail Khán as a dye stuff, but was probably imported into that district.

Under the Class of Dyes, (head Saffron), the reader will find some further information as to the cultivation and growth of saffron.

* Products of Bombay, 305. † AINSLIE, I., 384.

SUB-CLASS (G). SACCHARINE SUBSTANCES (INCLUDING HONEY).

This class contains two descriptions of goods.

(1). Sugars, raw and manufactured.

(2). Sweetmeats and confections.

The first are very extensively produced, but the kinds are few and the method of preparation rude. The demand for sugar is very great, and the export trade, both of sugar and molasses, very considerable. In no branch of useful manufactures is improvement more required, and in none is it of more easy application. We have all the materials at hand for producing the finest white granular crystalline loaf sugar, and all the other varieties of sugar used at home.

In the second class the sweetmeats are innumerable, and they form a large portion of the food of the people :—the insipid flour cakes and boiled pulses, just as they induce an increased consumption of stimulants, spices and pickles, so they give the people a taste for sweet things, which not only gratify the palate but also supply the large amount of carbonaceous matter requisite, especially when they are prepared, as they often are, with ghí. The sweetmeats are generally uncolored, or else adorned with silver leaf, and made into various shapes; but beyond the addition of cardamoms, rose water, and occasionally lemon, they are mostly excessively sweet, and that is all; the delicate flavors of European confectionery are unknown, and perhaps would not be appreciated if they were.

SUGAR-CANES, AND SUGAR THEREFROM.

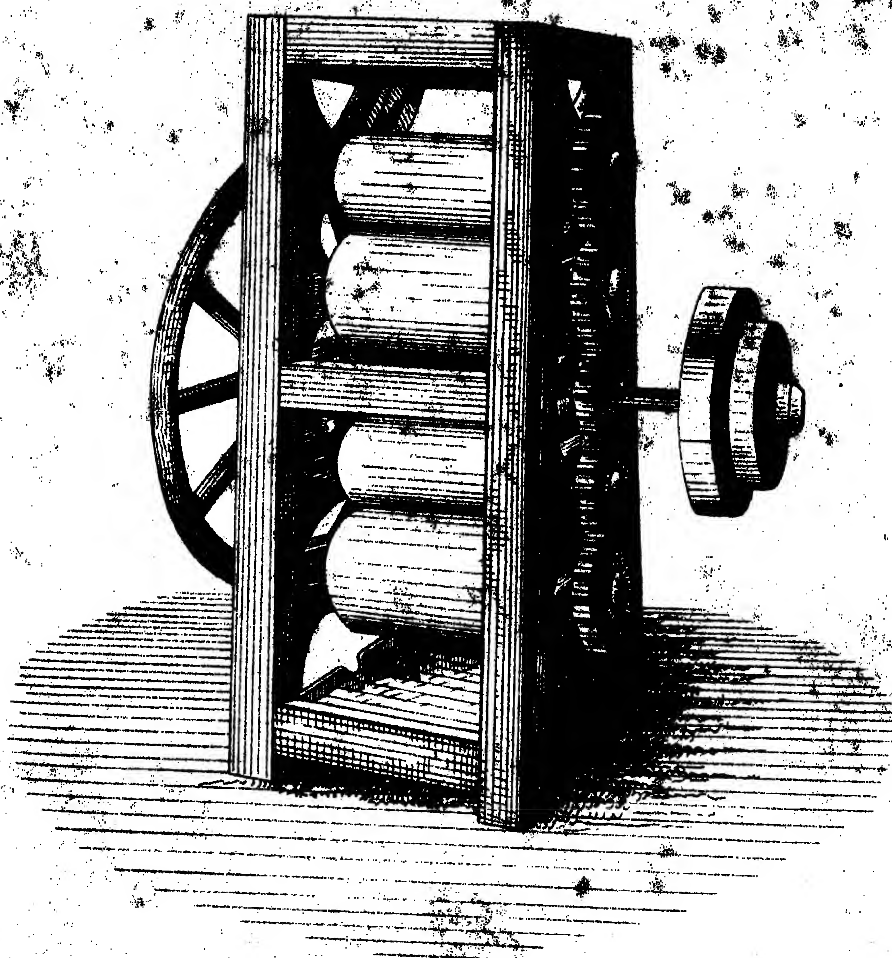
1052.—Synonyms — Kumád; nai shakar (Pers.); Ganná; Ukh (Hindustán).

The first thing to be done is to describe the culture of the sugar-cane, and the way in which the juice is extracted and converted into sugar.

In the Lahore district I obtained five kinds of sugar-cane; some of these were merely varieties. There is a purple cane, called "kumád kálá;" a hard thin cane, called kumád Lahorí; another called "kátá;" and others the plants of which were obtained from Jálandhar and Sahárampúr. The principle difference observable is in the size of the canes: one sort is very thick and succulent, and is principally used for eating: it is cut up into pieces, peeled, and sold in the streets: contrary to what one would suppose, the thin hard canes yield the greatest quantity and the best syrup; the succulent ones are too watery.

In Gujranwalla, MAJOR (now MAJOR-GENERAL) CLARKE mentions three kinds of cane: "Daulá," "treda" and "chinkha." Daulá, or white, is the best; treda is yellowish; chinka, which is reddish and small, produces good kand and chíní, moist sugar. The tops or leaves of the cane are useful as fodder.

"The sugar-cane is best placed on manured land. The first ploughings and levellings are given in the beginning of Bhadon, (along with the lands intended for the rubee crops,) after which the land lies fallow throughout the cold season; should the rains have been favorable, these primary ploughings will be only one or two. In Phágan the land is again ploughed three or four times, and setting commences sometimes within the same month, sometimes in the succeeding one. The cane intended for setting is cut in Magh for fear of injury from cold, it is then kept under cover of earth whence it is not taken, till the land which is to receive it be ready; the cane is then stripped and cut into bits of quarter yard long, and planted after the last ploughing, manure is used once before, and once after sowing, the earth at the roots must be loosened thrice, with a hand-hoe the fourth, and last time, with a spade. The more finely pulverized by ploughing, the better the crop. As a general rule, it may be said that land for sugar-cane should be, and is, ploughed fourteen or fifteen times, and levelled four or five times. The crop is watered every eighth or ninth day if the rains fail, otherwise every fifteenth or sixteenth day. In this pergunah (Háfizábád) the crop ripens in Magh, when the juice is extracted and boiled into goor. A machine called a "belna" is used to express the juice. The kolhoo, or oil-mill is not used for



SUGAR MILL.

the purpose, as is the case in many parts of Hindustán. It is well known that a *good* crop of cane yields at the rate of two and a half maunds of goor for every ten murlas, forty maunds per acre, the produce of one-eighth of an acre can be passed through the belna in twenty-one hours. To make the goor, the cane is first stripped of its loose outer coating, called "chái" by men called chelas: the peeled canes are then made up into bundles of fifty or sixty each, called "dubthá." They are then carried to the belna or mill, which a pair of bullocks turns: two men are seated on either side of the mill; the business of one of whom (the "dhora") is to feed the mill with the bundles of cut cane, and the other ("agoo") to free the pressed cane, a third man standing by ("khanchee") passes this back to the "dhora" or feeder, who again puts it in the mill or press, and this process is repeated, till no more juice will come from the cane. Besides these, a man is needed to drive the bullocks, a choora or sweeper to keep the fire going while the juice is being boiled, and a third man to skim the juice while boiling. Several other day-laborers are also employed; the pressed cane serves for fuel; some zumeendars have their own press and boiling pans, others are obliged to hire. The daily expense of manufacture is as follows:—

		As.
Hire of a pan for boiling, per day,	-	2
Hire of a belna or mill, ditto,	-	5
Pay of dhora or feeder, ditto,	-	3
Do. of agoo, or man who frees the cane from the mill,	-	3
Do. of "khanchee," or go-between,	-	2
Do. of choora or fireman,	-	2
Carpenter, one seer of goor,	-	1
Potter, ditto	-	1
Blacksmith, ditto,	-	1
Soap and oil for greasing the mill wheels,	-	1
Total Rs.,	-	1—5

Perhaps the *average* crop is in—

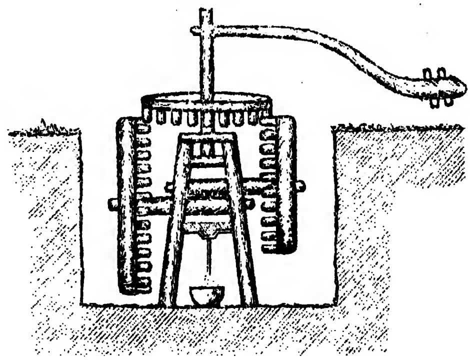
Khadir lands, 18 maunds per acre.

Bangur lands, 20 do.

Bordering the bar, 24 do.

Some zumeendars plant sugar-cane in Baisakh, after the wheat is off the land, two ploughings only being given, but the return is a poor one. When the crop is of inferior description it is only used as fodder for cattle. Cane is not planted in "Chet," or if it be so, worms or maggots, which then come forth in numbers, are apt to injure it. The poona or pownra cane is not produced in this part of the country.

The belna is a sufficiently simple affair, a capacious pit or well is first sunk, with a ladder or steps leading down to it: the mill itself is in the pit, and the oxen who turn the wheel which gives motion to the mill rollers, move round the mouth of it; the mill consists of two stout rollers terminated at either end by parallel toothed wheels made of wood. These wheels



are put in motion (and the rollers with them) by a horizontal toothed wheel, placed with the teeth downwards above the rollers, so as to catch its teeth in both of the parallel wheels. The horizontal wheel which comes up slightly above the top of the pit is fitted with a long bar, to which oxen are yoked for the purpose of drawing it round and round.

The rollers are thus set in motion, and the juice expressed is conveyed away by a sloping trough leading to a reservoir.

The "belna" is by far the most usual method of obtaining cane-juice, but in some places a mill is used similar to the kolú or oil mill. This consists of an immense wooden mortar, in which is placed a proportionably stout wooden pestle; the pestle is pressed against the edge of the mortar, and then by bullocks or men (through a lever attached to the upper end) is pulled all round the circumference of the mortar, the end of it remaining at the bottom of the mortar, but working about and crushing and pressing any material that comes between it and the floor and the sides of the mortar. This mill, though universally used for oil, is not commonly used for sugar. In some parts of the Hills a lever beam is used, the long end of which, armed with a weight, is let fall with repeated blows on the canes, just as paper fibre is crushed by the lever "janda;" such an apparatus, which is the rudest of all methods, called in the Simla States, "sál," and is described by Mr. Melvill.*

"The machine for extracting the juice from the sugar-cane, is highly unique, it is called the "sál."

* Northern Amballa Settlement Report.

Two men run up a long balanced plank and by throwing all their weight on the end of it, bring it down to the ground. This forces down a block, which presses the cane that had previously been cut up into small pieces and placed under it. The juice runs down an inclined board, into an earthen jar prepared to receive it below. This is a very rude kind of affair, and requires a great deal of human labor."

The preparation of sugar is described in the following extract.

The kinds of sugar usually met with are :—

1st. Gúr—molasses, black-brown.

2nd. Shakar surkh—also molasses, paler color.

3rd. Kand or shakar tari—coarse moist sugar.

4th. Búra or chini—amorphous white moist sugar.

5th. Misri—refined sugar, more or less crystallized: it is either "kúza misri," which is like candy crystallized in kúza or earthen pots, so that the sugar comes out like a hollow globe, crystals inside; or "tavá misri," a flat disc of sugar, crystallized in a granular crystalline mass in a taví or iron dish; this sugar is broken up into lumps for use. These sugars may be of different qualities and colors, according to the degree of refinement effected.

"There are different processes for separating the sugar from the cane-juice in different countries. The following is the method which obtains in the East Indies. The liquor, after being strained so as to separate the coarser feculencies, is boiled down in a range of open boilers heated by a long flue, into a thick inspissate juice, the scum which rises during the operation being removed. When it is sufficiently evaporated, it is removed into earthen pots to cool, and in these it becomes a dark colored, soft, viscid mass, called goor or jaggery. Sometimes a little quick lime is added to the juice before boiling, which, by partly clarifying it, renders it capable of being formed into cakes or lumps. In general, however, if intended for subsequent clarification, the juice is merely boiled down, and sold in pots in a granular honey like state, to the boilers or refiners. These separate much of the molasses or uncrystallizable part of the juice, by putting the goor into a coarse cloth and subjecting it to pressure. The sugar, which in this state is called shakar or khand, is further purified by boiling it with water, with the addition of an alkaline solution and a quantity of milk. When this has been continued until scum no longer rises upon the liquor, it is evaporated, and sometimes strained, and afterwards transferred to earthen pots or jars, wide at the top, but coming to a point at the bottom, which is perforated with a small hole: this, at the commencement of the operation, is stopped with the stem of a plantain leaf. After it has been left for a few days to granulate, the holes in the pots are unstopped, and the molasses drains off into vessels placed to receive it. The sugar is rendered still purer and whiter by covering it with the moist leaves of some succulent aquatic plant,* the moisture from which drains slowly through the sugar and carries with it the dark colored molasses. After several days, the leaves are removed, and the upper part of the sugar, which has been most purified, is taken away and dried in the sun. Fresh leaves are then added, by which another layer of sugar is whitened in like manner; and the operation is repeated until the whole mass is refined. The sugar thus prepared is called chini, and is that which is commonly sent to England."

Sugar when concentrated is highly antiseptic, and owing to its possessing this principle it is frequently employed in the preservation of vegetable, animal, and medicinal substances. Dried fruits are often preserved a long time by reason of the sugar contained in them. In cases of poisoning by copper, arsenic, or corrosive sublimate, sugar has been successfully employed as an antidote, and white sugar finely pulverised is occasionally sprinkled upon ulcers with unhealthy granulations. The Hindús set a great value upon sugar, and in medicine it is considered by them as nutritious, pectoral, and anthelmintic.

The collection of sugars, enumerated in the order of their quality and refinement, are as follows:—

1053.—Molasses, "gúr," "kand síyah."

Rohtak (3980); Hushyarpúr (3996); Sealkot (Zaffrowál), (4001); Lahore (4005) Gujranwalla (4019); Gujrát (4020); Shahpúr (Bhera), (4024); Muzaffargarh (4028) (value, 9 seers per 1 rupee); Peshâwur (4031); Jhínd (4038); Dera Ismael Khán (3379).

RED SUGAR.

1054.—(Coarsest moist sugar), shakar, "shakar surkh."

Rohtak (3981); Hushyarpúr (3997); Sealkot (4000); Lahore (4006); Gujranwalla (4018); Gujrát

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* *Vallisneria spiralis* and *Hydrilla verticillata* are employed by sugar refiners for this purpose.

(4021); Muzaffargarh (4029); Peshawur (4032); Kapúrthalla (4034); Jhínd (5037).

KHAND.

1055.—Coarse sugar, or shakartari.

Sealkot (3999); Bunnoo (4930); Kangra (shakartari).

CHINI.

1056.—Moist sugar.

Delhi (3974): Rohtak (3979); Ambálah (3985); Ludhiana (3987); Hushyarpúr (3995); Kangra (búrá), (3990); Gurdaspúr (3998); Lahore (4004); three varieties of chiní, of three degrees of refinement, observable principally in color, beginning with "shakartari" up to white sugar; these are imported from Sujanpúr and Pattánkot (Kangra); Gujranwalla (4017); Gujrát (4022).

The best kind of refined moist sugar is called misri, as is also loaf or lump sugar, which generally consists of sugar crystallized (granular crystals) in a huge iron pan, which forms, when the process is complete, a large disc of sugar, called "tavi misri:" this when pounded or broken into lumps, forming misri in lumps or grains.

Specimens are as follow:—

Delhi, refined sugar, misri (3973).

Lump sugar (3976).

Sirsa lump sugar (3982).

Kangra (Bawarnah misri), (3992).

Lahore "tavi misri," large disc or flat circular mass of crystallized (granular) sugar, as it comes from the "tava," or crystallizing pan.

Gujranwalla "misri" (4016).

Gujrát (4023).

Shahpúr, from Khúsháb (4025).

CANDY SUGAR.

1057.—"Kúza misri."

This is sugar allowed to crystallize in its natural crystals around the sides of a globular earthen vessel, and on threads suspended for the purpose, within the said vessel. When the process of crystallization is complete, the liquid syrup remaining is poured out, and the jar with its inner sides and suspended threads, covered with crystals of sugar, inverted to drain and dry. After this is completed, the earthen vessel is gently cracked, and the pieces picked off, leaving a hollow globular crust of crystallized candy sugar, having its inside filled with cross threads, also incrusted with crystals, this is called "kuzá:" they are made of all sizes, from small globes the size of an orange, which are often brought as presents on the occasion of a visit, to the large masses of Bikanair sugar. The kuza sugar varies in whiteness according to the degree of fineness of the syrup employed for crystallization.

BIKANAIR CANDY.

1058.—"Kúza Bikanairi."

The most esteemed variety of the sugar is the white transparent kúza sugar of Bikanair, which is imported into the Punjab, and is to be found principally in the district of Hissar, and others close to Bikanair.

Of this sugar, two fine samples were sent from Hissar (3977), enclosed in the earthen kúzas in which they were crystallized, and which would be broken off as above described. The samples are equal to the best white sugar-candy of European confectioners.

The following account of the method of making this sugar was communicated by the Vakíl of the Bikanair State.

The best and purest quality of moist sugar is dissolved and made into syrup—this is recrystallized into "khand" (moist sugar, becoming purified by this repeated boiling and crystallization). The khand so obtained is once again converted into syrup, with clear water, and this is now sufficiently pure to crystallize finally. Accordingly, a globular earthen vessel is taken, and a number of threads suspended in it, and into the vessel so prepared the syrup is poured. This is allowed to stand perfectly quiet, and in a place free from dust for three or four days. At the end of which the crystallization will be completed. The inverted "kúzas" are then placed mouth downwards over other vessels into which they drain. The outside of the kuzás, and the place where the mouth meets the vessels over which they are inverted are carefully smeared over and luted with clay, to keep out the dust. In this position they are left from five to seven days, at the end of which, the clay coating is carefully removed, and the kúza lifted up. The sugar in the kúza will be found to be crystallized white and dry, and then the earthern jar containing it is gently struck so as to crack it, the broken pieces removed, and the hollow globe of candy can be either preserved in that shape, or broken into pieces for convenience.

The superfluous syrup that runs off is available for re-crystallization with other sugar.

The best kind of sugar sells in Bikanair for Rs. 1 per seer; and the second quality 1¼ seers per rupee. The Vakil adds that there is no regular export trade in such sugar, but that many private persons purchase it and carry it to different parts.

He gives his opinion also, which he says is the common one, that there is a peculiarity in the

water of Bikanair, favorable to the purification of sugar.

From this account it appears that with care and cleanliness, sugar equal to Bikanair might be produced anywhere in the Punjab.

Sugar-candy was exhibited also from the following districts :—

Delhi (3976) ; Hushyarpúr (two qualities), (3993-94) ; Lahore, three qualities, differing in color from brown candy to white candy (4003) ; Kapúrthalla (4033).

1059.—[3983] Jalá, an aquatic plant from Bawarna, in the Kangra district. Local Committee.

This is a water plant *(Potamogeton?)* sometimes given as *Lemna cruciata*, which is used in the process of refining sugar. The plant when placed in the syrup, from its slender green spreading leaves, disperses itself through the liquid, forming a reticulated mass, which quickly attracts and catches all impurities floating in the syrup, and sinks with them to the bottom, leaving the clear syrup above.

HONEY.

1060.—" Saht " or " shahd."*

A number of specimens were exhibited as follows :—
Ambálah (3984).
Rohtak (3978), in the comb. Lt.-Col. Voyle.
Shahpúr (4039), from the Salt Range.
Jhang (4027), (Sho kot).
Kashmír, Srinagar, (4035). H. H. the Maharaja.
Farídkot (4036). H. H. the Raja.

SWEETMEATS.

1061.—Sweetmeats, " halwa," " mithaí."

It would be impossible to close this account of sugar without referring to sweetmeats, which are so universally consumed by all classes of natives, and are made of an almost infinite variety of forms, all distinguished by their proper names.

The number actually exhibited was very small, for most of them are of a perishable nature, or else being prepared with ghí and butter, are excessively greasy or sticky, and unsuited for exhibition.

* I have not included this among animal substances. The bee appears to act merely as the collector of nectar from flowers, while it does not appear that the substance itself undergoes any change or manipulation by the agency of the bee, honey frequently retains the fragrance of the flower from which it came, whenever there is a large growth of one kind of flower in the neighbourhood of the bees, as in the case of heather honey.

An ingenious manufacturer at Lahore and Amritsar prepared a number of articles of sugar, which were colored to imitate the real articles. These were as follows :—

1062.—Sugared almonds.

Almonds covered with sugar, like European confectionery.

1063.—Walnuts (imitation).

The shells being made of sugar and the kernel by that of the real fruit.

1064.—Almonds in their shells.

Prepared in a similar manner. Cardamoms and grains of rice (these, however, ingeniously imitated in wood and ivory) accompanied the specimens.

1065.—Dried dates.

Imitated in colored sugar.

1066.—A cup and saucer.

This is ingeniously modelled in opaque white sugar, in which a carefully copied Etruscan pattern is drawn into with crimson lake or cochineal.

1067.—Kernel of a cocoanut.

Also imitated and colored.

Several samples by the same maker were sent also from Amritsar.

The following is a list of some of the common kinds of sweetmeats in use in the Punjab.

1068.—[4007-15]. " Batásha, " a sweetmeat. Lahore bazar.
Lahore.

These are made in two sizes : they are light sweetmeats, in appearance like " ratifia cakes ;" they are made by dropping a quantity of thick syrup on to a hot iron plate, just before the drops hardens, a minute portion of potash or soda, " batásha," is put in, which acting like yeast puffs out the drop which then hardens.

Barfi.—There are two kinds—one made of máwá (or " khohah," *i. e.*, milk boiled till it becomes reduced to one-fifth of its bulk, and quite thick), and the other súji (or rawah). The first kind forms diamond-shape flat cakes, often covered with silver leaf for ornament, it consists of máwá and sugar mixed ; the súji kind is made by taking súji (flour) and mixing it with ghí, the mass is fried till it turns reddish-brown, and then " cháshni " (syrup) is poured over it in a plate : when cold it is cut up into diamond-shaped pieces.

Perá.—Made of máwá and chíní, in equal proportions, into flat round cakes.

Laddú.—Of two kinds, one called "búndi ka," the other is "sádá" plain, or "maidá ká." The first is made of "besan" (gram flour) and ghí and chíní, made into balls of a yellow color; the second kind is made of maidá (fine flour) instead of besan, and is white colored.

Bedánah.—Of two kinds, made either with "maidá" or "besan;" the flour is made into a thin paste and dropped through the holes of an iron cullender into hot ghí placed underneath: thus small grains, likened to "quince seed," are formed; these are afterward sweetened by dropping into syrup.

Búndi.—This is made like the last, only the grains are smaller, and always of "besan."

Jalébi.—Is exactly like vermicelli, it is of two kinds—either the threads of paste are dipped once into sugar, or if dipped twice, it is called "dobára."

Pethá.—Slices of pethá fruit (*Benicasa cerifera*), which are first boiled, then dried between cloths, and then dipped in syrup, made very thick; but another kind of pehtá is made usually with flour and ghí, to look like the real. It is a pleasant confection.

"*Gul bihisht.*"—Sugar and ghí and flour, cut into sticks or long thin pieces, colored with saffron.

Kálá kand.—Is in square cubes and dried.

Shákar párah.—A cake is made of maidá and water dough, which is cut up into square pieces and put into hot ghí, and after cooking, thrown into syrup.

Bádám kandi.—Very like "barfí," only pounded almonds are added to flavor.

Pista kandi.—The same with pistachios.

Guláb kandi.—The same, with rosewater flavor.

Khajúrán.—Made either of rice flour or of maidá: a cake is made of the dough, and then heart-shaped pieces are stamped out with a wooden stamp.

"*Akbari,*" or *Bálú shahi*, or *Khurma.*—Maidá made into round cakes, covered with sugar afterwards.

Jehángiri.—Just the same, except that rice flour is used in lieu of maidá.

Khatár.—Sugar and maidá and ghí, in equal parts are mixed together, and heated by being placed in a covered dish, *over* which a pan containing fire is placed.

Amrisah.—Often made with rice flour, and *gúr* and *ghí*; made into flat thin cakes.

"*Pakanrás.*"—Almost the same.

Sitta.—Sticks of sweetmeat made with máwá and sugar, covered with poppy seeds.

"*Jáman.*"—Is the same made into the shape of the jáman fruit.

Halwa Pashmak.—Made of maidá and chiní, drawn out into little threads.

Phéni.—Consists of vermicelli-like threads twisted in a bundle into shapes; it is eaten with milk and sugar.

Kewar.—Made of maidá, ghí, and chiní, into large cakes.

Pápar.—Sugar (chíní) made so as to be transparent, and then formed into a large pyramid.

Luchhi.—Maidá and ghí, made into very thin cakes.

Halwa.—Ghi and sugar, is put in a pan and maidá is stirred into it: it is amorphous.

Púri.—Made into cakes.

Chúrma.—An amorphous sweetmeat.

Sambhosa.—Formed into the shape of solid triangles (but taste *salt*).

Parákari.—The same in semi-circular pieces; sometimes it is made sweet.

Mathi.—Like "chapattis," with a little salt and ghí.

Kachauri.—In form of little cakes, inside of which a little powdered dál, called "píthi" is placed.

Phul kachauri.—Somewhat larger and puffed out.

Mongrá and *pakoura.*—Made of "besan," ghi and salt.

Badyán.—Sugared seeds of "sonf."

Khas khás.—Poppy seed, is prepared in same way; so is nakhûd, "gram."

SUB-CLASS (H). WINES AND SPIRITS, AND SUBSTANCES USED IN DISTILLATION; ALSO VINEGARS, THE RESULT OF LIQUIDS FERMENTED TO ACIDITY.

The samples in this class are few. Most districts thought it foreign to the purpose of the Exhibition to send such spirits—nor is this to be regretted. The manufacture of native spirits is almost the same everywhere, resulting in the production of a kind of rum, which is either white or a yellow color, being distilled from sugar-cane juice, and occasionally flavored with the flowers of the khavi grass (izkhar), *(A. schœnanthus)*, coriander, and other substances, especially the bark of the babul *(Acacia arabica)*. Formerly, on our assuming the Government, spirit making was merely taxed: various persons were licensed to make spirits, and paid a fee for the licence and the tax besides. This continued till 1861-62, when, after the introduction of the Sudder distillery system in Oudh, it was experimentally introduced into ten districts of the Punjab. It is now almost universally adopted. The system is fully described in the Circulars of the Financial Commissioner under the head "Abkári." (This term means literally the making (kár) of liquor or water (áb), and is applied to the whole system of excise arrangements generally). The principle of the Sudder system is to authorize only one distillery (or more if requisite), which is under control of authority; this is enclosed with walls and carefully watched; all spirits issuing thence are taxed according to quality and strength. The strength is ascertained by hydrometers; the temperature of the spirit tested is also ascertained by a thermometer; every distillery is furnished with these implements. No other person is allowed to have a still under any circumstances whatever. All spirits sold are made within the walls of the distillery, and special rules for its sale, &c., are enforced. Spirits are sold to licensed vendors in the cities and villages.

As before remarked, under the head "Drugs," the revenue derived from spirits has been up to 1860-61, realized in a general account, as "Excise," but the "Abkárí" receipts since then have been as follows:—

Year.	Amount in Rupees.	Remarks.
1860-61	3,77,535	(Result obtained by deduction from gross revenue under all heads).
1861-62	3,55,139	(In this year balances amounting to Rs. 51,366 were due).
1862-63	4,16,662	Do. do. Rs. 20,136.
1863-64	4,36,235	Do. do. Rs. 2,650. In this year the cost of establishment was Rs. 53,709.
1864-65	4,70,543	The cost of establishment was Rs. 65,347.

When the success of the experiment of Suddur Distilling was established, it was introduced in 1863 into all districts, and the revenue is now beginning to equal that obtained under the old system.

As nearly all districts follow the same method of manufacture, there is necessarily little variety in the out-turn, and all fancy varieties of wine are quite unknown. In Kábul, and other places where grapes grow, a spirit is distilled. The distillation was formerly practised in Lahore, in Ranjit Singh's

time, who used to drink the spirit often too immoderately.

The use of spirits is not very general, and by no means so with the agricultural population; some classes of natives are often drunk, and apparently esteem it no harm to be so,—with persons of the castes of Dhobis and Saises this is very common. Drinking is strictly forbidden to the Mussulmans; but it is to be feared the prohibition is often disregarded. To Brahmins and the higher castes of Hindús, spirits are an abomination. It must be confessed, however, that if all classes kept to these injunctions of their creed respecting spirits, the quantity consumed would be much less than it actually is.

A great advantage attained by the Sudder distilleries, is that the spirit is rendered at least pure and free from deleterious admixture, and quite unlike the filthy thick substances that may be seen in the hovels of the Black Town of Calcutta, under the names of "toddy" (tárí) and "arak." Tárí is never made in the Punjab; and, consequently, the palm trees are not hacked into step-like notches as they are in Calcutta and Bengal generally. The Hakíms occasionally extract from jasmine flowers, orange flowers, and other substances, essences or weak liquors; a large collection of these, from the Lahore district, was exhibited under the head of Drugs, to which class they exclusively belong, being only taken medicinally. They have generally a white color, with the taste derived from the essential oils of the substances used in making them.

I shall conclude with a brief account of the contents and products of a Sudder distillery, my information being derived from the Sudder distillery in the Lahore bazar.

The apparatus of a native distillery is very simple. A small furnace, a few vats, a large "deg" or earthen vessel, in which the distilling liquid is heated over the furnace, and several earthen pots, complete the whole.

The spirit is made thus :—

"Shíra" (treacle) or "kandsiyah" (molasses) is put into a wooden vat (pípa), together with certain spices and flavoring ingredients, which will be enumerated presently.

Some "lahn," or lees of wine, previously made, is then added, and a third part of water is poured in; this mixture is allowed to stand for three or four days. When it is fermented, the vessel is filled up with water, and after standing two or three days more, the liquid is turned into the still.

The still consists of a large copper "deg," the mouth of which is closed with a hollow earthen pot inverted over it, and the joint luted with a mixture of flour and water. On one side of the cover, there is a hole, into which the still pipe (necha), made of bamboos, is inserted; the necha or pipe, leads to a "pabka," or copper vessel placed in water, to keep it cold. Thus a rude still is made, into which the liquor previously described is poured, and the fire in the earthen furnace beneath is lighted. The first spirit that passes over is called "phúl" and "ekátshá," or once distilled. This is collected in a vessel and distilled again in another still, when the spirit passes over it, is called "doátshá," or "double distilled." This is of two qualities, according to strength.

The spirit is now tested by a hydrometer. The strength of the first is from 75° to 100°, and the other less than 75°. The licensed vendors on presenting their "rawánahs," or passes, purchase the tested spirit, having paid on it the duty, (mahsúl,) so much per gallon, according to the strength.

Each distillery is furnished with a hydrometer, a thermometer, to ascertain the temperature at which the spirit is tested, a standard gallon measure, a trial glass, and a measure called "sharáb náp wán."

The spices and flavorings, or "masálah" used in distilling, are the following :—

1. "Sak" or bark of the kikar, which is often erroneously supposed itself to yield a spirit on distillation; it is only added to promote and accelerate the fermentation of the molasses, &c. 2. Triphalla (the three *Myrobalans*, mixed together as an astringent). 3. Rose leaves. 4. Lotus flowers (nilofar). 5. Kahzabán (*Cacalia kleinii*). 6. Violets. 7. Badyán (anise seed). 8. Limes and lemon peel (sangtará). 9. Saffron. 10. Sandal wood, red and white. 11. "Mundi buti" (*Sphæranthus*). 12. Kashniz (coriander.) 13. Adrak (ginger). 14. Iláchi (cardamoms). 15. Músli. 16. Dárchíni (cassia or cinnamon). 17. Gájar (carrots), dry and fresh. 18. Motya (jessamine). 19. Seb (apples). 20. Náspati (pears). 21. Shir (milk). 22. Raughan (ghí). 23. Meat (?). 24. Misri (sugar). 25. Tamál patr (aromatic leaves) 26. Taj (aromatic flavoring leaves). 27. Bedmusk (willow flowers). 28. Kastúrí (musk). 29. Ambar (ambergris). 30. Khawi (*Anatherium murica-*

tum). 31. Khas (root of the latter). 32. Chobchini (*Smilax china*). 33. Salep misri.

Some of these are purely for flavoring; others as triphalla, nilofar, &c., for their medicinal, cooling, and restorative properties; they are added several, or all, according to the fancy of the manufacturers. With regard to the addition of the astringents in distilling, I may add that the same is done in wine making in Spain. The twigs and stalks of the cluster of grapes, as well as the skins of the grapes are highly astringent; and I have been told by a maker in Portugal, that it is impossible to make good wine unless the stalks and skins are trodden out with the grapes, and that he tried to make wine by preparing only the pulp of the fruit by itself, and the result was a complete failure.

1069.—[3872]. Country spirits. Peshawur. Local Committee.

Distilled from Kábul grapes.

1070—Common spirits. Lahore bazar.

The produce of the Hill breweries is represented as follows:—

1071.—[2921]. Beer and porter. Simla brewery, Simla. Messrs. Hay & Co.

1072.—[2921B]. Beer and porter. "Kussowlie Brewery," Kasauli. Mr. Johnson.

Of fermenting materials we have—

1073.—[3815]. Phao," from Lahaul.

A substance, which put into the mixture called "lúgri," when the fermented materials are placed on the still.

1074.—[3816]. A drug, from Spiti.

Used to promote fermentation: its local name is not given.

1075.—Chang. Spiti.

A liquor is distilled in Spiti from barley, and called "chang," and is sold at 30 puttahs for the rupee. A "puttah" is a liquid measure of 2 seers = ¾ of a pucka seer. "They consume," writes Captain Hay, "large quantities; and one man is said to drink on occasions of festivity as much as four puttahs." "Chang" can be made from other grains besides barley, that made from rice is superior, the wealthier classes in Spiti, &c., use a weak spirit, called arak, which is distilled from rice.

VINEGAR—SIRKAH.

Only three samples of vinegar were exhibited.

1076.—[4045]. Vinegar. Peshawur. Local Committee.

1077.—[4419]. Vinegar (brown) from Lahore. sugar-cane.

1078.—[4420]. White vinegar, from grapes.

The vinegar obtained from sugar-cane juice is generally a poor stuff, and does not contain more than 2 per cent. acetic acid; but at some places it is made well, especially at Delhi. A large number of bottles of vinegar sold in the country, with the ticket and capsule of "Crosse and Blackwell," are in reality bottles which once contained the real article, but when emptied, are refilled with country vinegar, and sold a little cheaper under the above name. I have seen however really excellent vinegar from Peshawur which was made from grapes: it was quite fit for table use.

This Sub-class closes the collection of Division I. of Class III., viz., Substances used in Food. Separate Jury Reports on Sub-classes A. and D. were prepared, owing to the magnitude and importance of the classes; but Sub-classes B., C., F., G. and H., forming the remainder of the division, fell to the lot of one Jury, whose Report here follows:—

REPORT ON SUBSTANCES USED FOR FOOD.

SECTION A. CLASS III.

DIVISION I.

SUB-CLASSES (B), (C), (E), (F), (G), AND (H).

JURY.

MR. R. EGERTON,
DIWAN BAIJNATH,
FAKIR SHAMS-UD-DIN,
RAHIM KHAN,
MUHAMMAD HUSAIN,
MR. JONES,
DR. J. L. STEWART.

REPORTER—DR. J. C. PENNY.

THE Jury took into consideration all the Sub-classes of the food division of Class III., with the exception of the very large, and to a great extent distinct class of Agricultural Produce, and also that under which tea was exhibited. These were very properly considered and reported on by separate juries.

The subjects considered by the present jury, therefore, are the following:—

Sub-class (B). Products of the ground, other than grains, which are used as food.
" (C). Dried, preserved, and pickled fruits, &c., &c.
" (E). Intoxicating drugs.
" (F). Spices.
" (G). Saccharine substances (including honey).
" (H). Wines and spirits, and substances used in distillation.

It is a matter of regret that some of the more perishable of these articles were considerably damaged by flies and other causes, before the jury could assemble for their consideration; and in a future exhibition the subject of devising some better means of preserving such specimens will require attention.

The first Sub-class contained all miscellaneous roots, tubers, greens, mushrooms, berries, &c., that are occasionally or commonly consumed by the population of the districts producing them.

Some of these are the produce of the common jungle or waste lands, others are regularly cultivated; but among the most remarkable were the products of the Thal or sterile sandy portions of the Muzaffargarh district. The berries of the *Salvadora*,—the seed pods of the jhand (*Prosopis spicigera*), which are ground up and made into bread, when dry,—the acid berries of the *Withania coagulans*, used to curdle milk with,—the shoots of that singular plant, which is occasionally found in jhand and pílu thickets, the *Boucerosia edulis*,—and also dried mushrooms,—were among the edible products of the district.

The jury consider this collection worthy of Honorable Mention.

Included in the class of miscellaneous products were some very fine potatoes, which deserve especial notice; they were grown in Hazara.

There was also arrowroot (3966), exhibited by MR. TAYLOR of Jálandhar: the cultivation and preparation of the root is an object greatly to be encouraged in the Punjab. The jury award a Silver Medal to MR. TAYLOR for the sample. A bottle of well prepared arrowroot was also exhibited by DR. JAMESON from the Dehra Dhoon, together with a series of the tubers of *M. Arundinacea*, as they are dug up from the soil.

A curious yellow concrete of the pollen for the dhúb grass *(Typha elephantina)* was exhibited from Dera Ghází Khán: the powdery pollen is collected and formed into lumps apparently with sugar.

Some Kábul salip was sent from Peshawur: this deserves attention, as it is a most pleasant and highly nutritious article of diet. A small quantity (about a desert spoonful) of the powdered root, stirred into a quart of boiling milk and sweetened to taste, makes a delicate flavored diet for invalids, &c., very superior to arrowroot in nutritiousness. Though an expensive article to buy, it is really economical enough, for a little goes a great way.

The next Sub-class contained a very fair assortment of fruits, in all the different kinds of preparation—dried, preserved and pickled.

Considering, however, this part of the collection as a whole, it is evident that the contributors in the several districts aimed rather at illustrating the nature and extent of their productions as they are, than furnishing evidence of any special or general effort being made to improve them by art or cultivation.

There were many samples of hazel nuts, walnuts, and the jujube fruit, which were ordinary of their kind, and need no special remark. The dried "amlok" fruits, from Hazara, are uncommon.*

The whole subject of the cultivation of fruits in India is far too extensive to be taken up here; but it is one which needs great attention. The list of fruits, so called, that grow in the Punjab, is a lengthy one, but the number that deserve the name of fruit is small.

Mangoes are only to be obtained of any excellence in a very few places.

The India plums (alúcha) are mere apologies for the grateful fruits of Europe that pass by the same name. Grapes and plantains may be added to the list of fruits, which are capable of great improvement.

Some progress has however been made. Attempts to cultivate the cherry have not been altogether without success; and this year (1864) a single cherry—the first in the Punjab—has ripened in the garden of CAPTAIN (now LIEUT.-COLONEL) ELPHINSTONE, at Jálandhar. Samples of dried currants were sent from Simla and Kangra; the latter were perhaps the best, but they are badly packed and preserved, and not nearly equal to those produced in the Mediterranean. Attention to picking, drying and packing could be easily given, and would result in rendering this much used fruit far more marketable, as well as pleasant for use. There is an acid currant, called by the natives "zirishk," equally with the sweet currants; it is, however, the dried fruit of the berberry.

The tamarinds from Ambálah were very fair: but the fruit is very seldom produced in the Punjab, and the tree is altogether out of its zone in the upper parts of the province.

* The fruit of *Myrica sapida* is not uncommon in the Hills. MR. FORTUNE observed in visiting the tea plantations in 1861, that there was a variety of this fruit in China as large as the Orleans plum, and very superior in quality: it might easily be introduced in the Hills if grafted plants were preserved.

A tree or two grow in some of the Gardens of Lahore, and even bear fruit, but it is a rarity. Some fresh Malta oranges of very fine color and flavor were exhibited by Mr. A. Brandreth, from his garden at Gujranwalla, where the trees flourish. Here is another instance of the improvement of Indian fruits, and it might be extended much further. Of preserved fruits the principal collections were from Lahore and Peshawur.

The jury expressed high approbation of the Lahore collection. It was large, carefully got up, and in every respect the best. It was found, on examination, that the excellent condition of these fruits was due to more careful corking, than was apparent in the contributions of other districts. The following samples of preserves—(3619) mango, (3620) apple, (3621) plum, (3622) melon, (3623) quince, (3624) lemon, (3625) ámla; and the preserved ginger, exhibited by Tehsildar Barkat Ali Khan, were capitally preserved, and care had been bestowed on them. The jury award to this collection a Prize of Rs. 30.

Next in order of merit comes the Peshawur collection, which contained some uncommon fruits, being the produce of Kábul. Among these were cherries, pears, apricots and plums. The jury award to this collection a Prize of Rs. 20. This collection contained also among its dried fruits, the khinjak and the "sanjid," or *Eleagnus* fruit, which were remarkable.

Judging them as a whole, the jury observed that there was generally speaking a too great preponderance of sugar about the preserves, and the natural flavor of the fruit was not retained.

Dates were exhibited under a variety of forms,—dried, whole, split, cooked in oil, &c., &c. These dates are universally inferior to the dates of the African shores. The best sample came from Dera Ghází Khán, though 10 samples were exhibited. The jury award Honourable Mention to this district.

In connection with currants, above noticed, raisins might have been spoken of. Those exhibited were the produce of Kábul, and a finer fruit can hardly be desired. They are prepared both by drying in the shade, in which case the raisins are a greenish color (being made from green grapes), and in the sun, when they get brown. There are two varieties, a large one with seeds, called munakka or dákh; the other, what are called in Europe sultana raisins, small, fine and seedless grapes. Nothing is wanted in these but careful packing and drying, so that the samples should not be full of sticks, dirt and foreign matter.

The same remark applies to the figs of Kandáhar.

There was a considerable show of pickles: some of them in vinegar and some in oil, and some merely consisting of slices of the root or vegetable smeared with ground mustard seed and oil or water, and left till the stage of acidous fermentation. Some of these will keep for some time, but the majority are intended for almost immediate consumption. There were pickles of red pepper, the *Myrobalan* fruits (halela and áñwla), potatoes, turnips, carrots, zamin kand, &c., &c.

The best pickles were those from Gujranwalla (3647). No samples of chutnies were produced: the foundation of these condiments is "khatái," slices of mangoes salted and dried, which are kept for this purpose or used by themselves, as a zest or condiment.

The next Sub-class contains intoxicating drugs. The most elaborate collection is exhibited by Daroga Gori Shankar. The collection contains the following—Bhang, ganja, charras, and opium—these articles are included under the term "muskarát," and are only sold by persons who have licences. Tobacco is sold without restriction. Dhatúra is not commonly to be met with, and is considered as a poison: it is this narcotic drug which was formerly employed by the Thugs to stupify the victims of their intended robbery.

In the Punjab there is no restriction placed upon the cultivation of opium, bhang,* &c.; only, as before remarked, the sale of these articles is subject to regulation. Bhang is exhibited from nearly every district where it is cultivated exclusively for the sake of the drug and not for the valuable fibre which the plant affords. There is hardly any difference between the various samples. Bhang is prepared for use either by mixing up the dried or powdered leaf with flour and water into thin cakes, or else it is macerated with water in a pestle and mortar, and the decoction after being strained is either made the ingredient of a sweetmeat or is drunk plain. A whole series illustrating this process is exhibited by Daroga Gori Shankar. The jury award to this collection a Certificate of Merit. The specimens of charras exhibited were imported from Bukhára and Yarkand. There were 18 samples of opium. Most districts in the Punjab produce a little opium, generally of rather an inferior character, but only for local consumption. The best opium comes from Kúlú and Rampúr; a good deal is produced in the district of Shahpúr. Among the collection before the jury no sample was worthy of particular notice, although the specimen from Gujrát was clean, and had a fine aroma. A very fair sample was forwarded by H. H. the Raja of Kapurthalla. There were a great many specimens of poppy heads, whose only difference was in their size—some being very large, and some being quite small.

Of tobacco there were a large number of samples, all prepared by the leaves being rudely tied up in bundles, or twisted together in the usual manner. Native dealers value tobacco according to its strength; the best tobacco is strong (karwa) enough to bear mixing with an equal weight of "gúr," to prepare it for smoking. This mixture of gúr is necessary, because in the chillam of the húka the tobacco is put on the top of hot charcoal, and left there; and some damp substance is necessary to prevent the tobacco being consumed all at once, as it would be if put in the chillam plain. A very fair specimen of "Cavendish," prepared in the American manner, from native leaves, was exhibited by Mr. Taylor of Jálandhar. The same gentleman exhibited tobacco in cakes, like honey-dew; to these samples the jury award a Prize of Rs. 20. It is understood that Mr. Taylor contemplates forming a company to grow and prepare tobacco. The experiment is an interesting one: tobacco grows easily and well in manured lands all over the Punjab; if attention were given to its cultivation, and to the selection of good seed, whether of the esteemed Persian or American and West Indian varieties, there can be no doubt that a first rate leaf might be produced, and then the introduction of American methods of preparation would easily follow. Still the getting a good leaf is the matter of primary importance, and perhaps no district offers greater facilities than the rich and fertile Jálandhar Doab.

The next Sub-Division, containing spices, had hardly anything in it worthy of remark. There were a large number of boxes of coriander, all alike; and the white and black cummin seed and carraway seed. There were also 11 samples of capsicums; those of Shahpúr being particularly large and fine.

Ginger and turmeric represented the Hill produce; and cardamoms, areca nuts, and black pepper, are all imported spices.

There was one sample of cinnamon, or rather cassia bark, from Bakót, in Hazara; it was a good sample, the flavor of the bark being scarcely inferior to the real cinnamon, and forming an agreeable spice.

The Sub-class containing wines and spirits was scarcely represented at all, save by some

* On poppy fields an acreage is charged.

samples of Hill beer and porter, and the spirits by some native spirit distilled at Peshawur, from Kábul grapes.

The beer and porter from Simla did not give satisfaction; but this was very probably owing to bad corking.

The Kussowlie beer was full bodied and very good; specimens were sent to the Chemical Examiner to determine the proportion of alcohol.

THE MOST EXTENSIVE Sub-class was that containing saccharine products. The manufactures in sugar in several parts of the Punjab are extensive; and the exports, especially to the south-east, are considerable.

In this class some fancy works in sugar were exhibited, and also a very large number of specimens of sugar in its various forms,—molasses, unrefined and refined, the latter including misri, chíní, kand, lump and loaf sugar.

The crystalline masses of sugar candy, of which there were 14 specimens, were all of good quality. Lastly, there were some curious sweetmeats of Lahore, imitating walnuts, almonds, cardamoms, rice, a cup and saucer, and a cocoanut.

The best specimens of refined sugar, *misri*, were those numbered (3988), exhibited by the JALANDHAR COMMITTEE, and (3991), produced at Bawarnah, and contributed by the KANGRA COMMITTEE; they were pronounced to be equal in point of fine grain, purity and merit generally.

The best *chíní* was that contributed by the TEHSILDAR of Pathankote, and bearing the Catalogue number (4004).

The sugar candy sent from Hissar (3977), was by far the best sample of this form of refined sugar: it was imported from Bikanair, where this kind of sugar is made to a great extent.

There was also a fine large flat plate or disc of crystallized sugar from Lahore, it is called "taví" sugar, from the large iron pan (taví) in which crystallization goes on; this form of sugar when broken into lump is that commonly used for household purposes.

Notwithstanding the great excellence of many of the samples of sugar exhibited, there is still great room for improvement. The best samples of loaf sugar are quite inferior to the beautiful snow-white, granular, crystalline manufactures of Europe; but there seems no reason why the manufacture should not be carried to perfection here, since every appliance is at hand.

The Bikanair sugar is equal to the white candy-sugar of English confectioners; but why should not the manufacture be established in the Punjab? the only requisites appear to be pure water, and great care in refining the syrup, by crystallization and re-solution, till the required degree of purity is attained. The JALANDHAR MUNICIPAL COMMITTEE have taken up the subject with such interest, that these matters are well worth their considering. Every effort should be made to secure great cleanliness of vessels, &c., and water; great care in cleaning the boiling syrup, and sugars quite equal to European might be produced.

With regard to the Prize of Rs. 100 offered by the JALANDHAR MUNICIPAL COMMITTEE for the best refined sugar, it is found that the sample (3991) from Kangra, and (3998) from Jálandhar, are equal in merit, the prize should therefore be divided, and half awarded to each exhibitor.

The jury award also to the Lahore collection of fancy articles in sugar, made by ABDULLAH, a Prize of Rs. 20; and a similar prize to the samples (4004) and (3977).

J. C. PENNY, M.D.

CLASS III. DIVISION II. DRUGS.

*General Remarks on the Vegetable Drugs in the Exhibition at Lahore.**

In drawing up the accompanying description of the vegetable drugs, great assistance was afforded by DR. STEWART, whose botanical skill and acquaintance with the flora of most parts of the Punjab, enabled him recognize a considerable number of drugs which would not have otherwise been easily determined by the jury.

The vegetable Materia Medica of the Punjab appears to be principally derived from the native wild and uncultivated plants growing there, such as—"shahtara" *(Fumaria parviflora)*; "Isfand Lahori" *(Peganum harmala)*; bahuphalli *(Corchorus depressus)*; ber *(Zizyphus jujuba)*; &c., the properties of which have probably been learnt by repeated trials.

But, together with these, are a considerable number of drugs not produced in the Punjab, but which are articles of ordinary trade among Eastern nations, such as the spices—cloves, cinnamon, nutmeg, &c.,—coming from more tropical regions; and rhubarb, musk, and assafœtida, the produce of the more northern mountainous districts.

A third class of drugs might probably be formed, of those which were introduced by the Mahomedan hakíms, who had studied from the Arabian school of medicine who, themselves, derived their knowledge from the Greeks. To these, without doubt, are owing the use of a few drugs which are not native to India, such as *Hellebore*, *asarabacum*, *Pæonia corallina*, &c.; but it is now certain, that in the Punjab at least, most of these medicines, although resembling somewhat the drugs used by the Greek physicans in appearance, are widely different in nature, and are generally derived from plants which are really natives of India. Thus it will be shown that the specimens called "kálí kútki," which in most books on Indian medicine is termed *Helleborus niger*, is in reality exactly similar to "kaur," the produce of the *Picrorhiza*; while the "asarún," which even in the native name, attests its resemblance to the *Asarum Europæum*, is probably a species of Valerian.

A fourth class which, however does not include many of the drugs shown, may consist of those plants which are used from a fanciful resemblance of some part of the plant to some part of the body, and the consequent supposition that the drug was intended to benefit that part when affected with disease. Thus the *Helicteres isora* is supposed to resemble in its coiled up fruit the convolutions of the bowels, especially when afflicted by the twisting pain of cholic; and "sálap misri" has been considered not only by Indian, but by European herbalists, to be of especial benefit to that part of the body from which the name of the order to which it belongs is derived. This idea has been commonly employed for the selection of medicines in Europe as well as India, and is called the Doctrine of Signatures, it being supposed that each drug was signed by its appearance for the function which it might affect in the body; but it is needless to say that this assumption is not confirmed by experience.

Among the collection of vegetable drugs there were but few which merited especial notice from their peculiarity of appearance; but there are some which may be referred to either as having been hitherto incorrectly named, or as being not unfrequently confounded with other drugs on account of the resemblance of their native names. These will be first alluded to, and then all the drugs will be arranged according to the natural system of affinities generally used in European botany; the use of each, as far as it is known, either in European or native medicine, is also added.

The first drug to be mentioned is the "kálá zíra," (or jira.) This is sometimes confounded with the "kálí zírí" *(Serratula anthelmintica)* or the "kálá zíra" *(Carum gracile)*: but on sowing the seeds the plants which were produced were easily distinguished, and it at once appeared that the "kálá jirah," a small triangular aromatic seed produced a plant which belonged to the natural order *Ranunculaceæ*, and which proved to be the *Nigella indica*, also called "kalonja;" while the "kálí jírí" produced a plant which evidently was included in the *Compositæ*; and the "kálá zíra" germinated, forming a plant which resembled one of the *Umbelliferæ*.

There has also been some confusion between the

* The whole of this division is written by DR. BURTON BROWN, Chemical Examiner; occasionally additional matter from other authorities has been added to his description.

names of chiraita, "keraita," and "chitra," with various modifications, such as "cherra," "chitra múl," &c.; after some examination it was found that "chitra" was usually applied to a branched pinkish root, the tincture of which gave a red precipitate with magnesia, and which in this as in other respects resembled the *Plumbago zeylanica*, while the "chiraita" was applied to some square stems with opposite branches which belonged to the useful tonic *Ophelia chiretta*, and which is now admitted into the British Pharmacopœia. There remained several yellow root stocks, with the bases of circular stems attached which were variously designated "karaita," "cheraitra," "chitra múl," "chitra pahári," "chari," and which evidently resembled a root called "phali-jarí," previously recognised to be that of the *Thalictrum foliosum*.

Another substance on which the natives appear to set great store, the "mámirán," resembles closely both in appearance and color the stalks of the "phali-jarí;" and has, therefore, been referred either to that or some other species of Thalictrum.

Another substance, "sat gilo," is worthy of notice, being as an attempt by the natives to obtain an extract of a valuable drug, but unfortunately from their faulty method of manipulation, they have only succeeded in obtaining what is little more than boiled starch. It is said to be made by boiling the root for twelve hours in water, then straining and evaporating to dryness. A much more efficient preparation would be made if cold spirit was used instead of boiling water, as then only the active principle would be taken up and none of the starch: but the objection to use spirit in preparing medicines renders most preparations which do not contain the solid remedy, of but little power.

Todri. This name has frequently been applied to mallow seeds, but in the specimens sent to the Punjab Exhibition, it was applied to seeds which evidently belonged to the order *Cruciferæ*, both from their external appearance and from the plants which they produced when sown. There appears to be two principal sorts—"todri lál," or "súrkh," or "zard," which is the seed of the wallflower (*Cheiranthus cheiri*), and "todri safaid," "níla," or "náfarmáni," which are the seeds of the common stock (*Cheiranthus annuus*), and which produced plants evidently belonging to this species.

One specimen of "todri súrkh" was apparently the seeds of common cress (*Lepidum sativum*); but this was in all probability sent by mistake, as all other specimens of cress were named "halím" or "táratezak."

Zirishk. Some confusion still existed respecting this name, but the specimens in the present exhibition evidently show that there are two totally dissimilar kinds—one, "zirishk shirín," is evidently a species of raisin, derived from the *Vitis vinifera;* the other, "zirishk talkh," is a very austere berry, which resembles the fruit of the berberry (*Berberis lycium*). The wood of this tree was said to be called "chitra," but neither of the specimens sent to the Exhibition bore that name, while the specimen styled "chitra," *Berberis*, proved to be *Thalictrum foliosum*: as this root resembles the wood of the *Berberis* in color, though not in form, it is possible that the name of *Berberis* has been sometimes applied to it by mistake.

Músli. This name has been variously applied to a variety of roots—1st, a tawny red light-textured root, resembling that of the cotton tree (*Bombax heptaphyllum*), has been called "músli sembal," or "músli safaid;" but the latter name has been more frequently used to a fluted white semi-translucent long narrow stem, resembling the "sátawar" (*Asparagus racemosus*); while the third kind is a small cylindrical blackish root, which is called "músli siyah," and is attributed to the *Commelyna scapiflora*.

Mocharas. Some difficulty exists respecting the drugs which have been sent under the name of mocharas. Many of them consist of a resin of a bright red color, which has been attributed to the *Bombax heptaphyllum;* others are more translucent and pinkish, and resemble to a great degree the resin of the sohánjna tree (*Hyperanthera pterygosperma*); while a third set are more similar in structure to an excrescence, having apparently an epidermis. Further enquiry is necessary to ascertain the exact relation of these apparent galls to the genuine gum resin.

Helicteres Isora. This substance is a singular twisted fruit of a plant belonging to the natural order *Byttneriaceæ:* it is used for the cure of cholic and diarrhœa, on account of the supposed resemblance between its twisted and convoluted carpels and the coils of the intestines, especially in the former disease; and is one of the examples of the application of the doctrine of signatures already referred to.

Peganum harmala. The seeds of this plant are often called "Ispand Lahori," as well as "hurmal," but the former name is often confounded with "Ispand" (*Withania somnifera*); this plant is said to be the source of the "hurmala red," sometimes used in dyeing silk pink, and might therefore become an article of commerce as it is in many places a very common weed. It has been supposed that it derives its name "harmool," from its connection with the μῶλυ of Homer, but this is very doubtful.*

* See Odyssey X., 305. Where Hermes gives it to Ulysses as a countercharm to the spell of Circe.

Mucuna pruritis. A very good specimen of the pods, with the peculiar hairs of this plant was shown (No. 1348) from Hushyarpúr. Formerly the hairs were much used in England as a mechanical anthelmintic for tape worm, but the hair of the "kamíla" (*Rottlera tinctoria*) has lately been substituted for these in Europe, as it has long been in India employed in this affection.

Assafœtida. An interesting specimen of the root of the *Narthex assafœtida*, obtained from its most southern habitat in the Pangi valley, was exhibited by Dr. Cleghorn. The root on being sliced, gave out distinctly the odour of the drug.

There was also a very interesting specimen of the root of the *Angelica archangelica* from Simla, called "chora."

Bábunah. This drug, though stated in books to be the chamomile (*Anthemis nobilis*) was evidently in this Exhibition replaced by the flowers and stalks of the common *Matricaria chamomilla*, and it is at least probable that this substitute generally occurs.

'Akarkarhá. This drug is also stated to be the *Anacyclus pyrethrum*, (Pellctory of Spain,) but the drug, as well as "pokarmúl," resembles in taste the lower end of the stalk of the *Spilanthus oleracea*, a common composite plant in gardens.

Gokru. This name is applied to several, more or less, spiny fruits. The most common is the "gokru chota" or "khurd," which is the spiny fruit of various species of *Tribulus*, which is occasionally used as food in time of scarcity. Another kind, with four angles, is the fruit of *Pedalium murex*, and is sometimes called "gokru kalán, large gokru;" while one specimen proved to be the muricated capsule of *Momordica muricata*, one of the Cucurbitaceæ.

Manna. Several kinds of manna used in native medicine were exhibited, but all much inferior to the European drug. One of these in small dark grains is the "turanjabín," said to be derived from the *Alhagi maurorum*; another somewhat whiter, is the "sherkhist" or "shaklú," which is believed to be produced by a species of *Fraxinus* in Kábul; and lastly, the "shakar taghár," which is a round cell, resembling in shape a small gall; this is said to be produced by the puncture of an insect on the *Calotropis procera*, "akh" or "mudár,": it has a sweet taste.

Ustúkhúdús. This odoriferous labiate plant has generally been attributed to the *Lavendula stœchas*, but its appearance evidently proved that it was a species of *Prunella*.

Kaspat and *Uglá.* These two triangular sorts of seeds, evidently of the same kind, produced when sown a plant which was recognised as the *Polygonum fagopyrum*, used principally as food in the hills.

Asarún. Several specimens of a root having this name were sent, but on careful examination they appear more similar to the roots of the *Valerian*, both in taste and smell.

Hussan Yusuf (1975), Lahore. This is a very interesting specimen of the *Siliceous frustule* of one of the Diatomaceæ. It is of a pyramidal form with a convex base, and on each triangular face is a prominent rounded knot; these markings are not affected by acids, and remain after heating to redness. When heated in a reduction tube, it gives off a peculiar smell and combustible gas, showing that it is quite in a fresh state, otherwise it appears somewhat similar to a fossil. Hussan Yusuf is collected in lakes and ponds in the hills around Srinagár in Kashmír. It floats on the surface and is skimmed off and dried.

The medicinal use of preparations of vegetable drugs has been for a long time of the greatest importance, and until a comparatively recent period the number of drugs obtained from plants and animals greatly exceeded that of preparations from the mineral kingdom. This depended on the fact that until chemical knowledge was fixed on a firm basis, it was only with great difficulty and after many failures, that chemical products could possibly be obtained; while on the other hand, the different parts of plants to which a medicinal use was assigned were easily distinguished, and procured without much trouble. In Europe, owing to the progress of science, mineral preparations are now most extensively made and used for medicinal purposes, and many of our most valuable drugs are derived from this kingdom. But in India, the knowledge of chemistry is confined to those among the natives who have been instructed by Europeans; and, therefore, medicinal substances procured from the mineral kingdom are comparatively seldom made or used, excepting by those who have been so taught; or those mineral articles are used which are procurable without much skill in preparation; they are often of little efficacy, as the list of mineral drugs already given will show. The use of vegetable drugs would probably be the first to recommend itself to those seeking relief from pain and disease, both because plants are every where at hand, the number of different kinds of plants are very great, their forms are distinctive and often peculiar, and in some cases they have been supposed to bear a more or less obscure resemblance to certain parts of the body, either in health or when diseased. Thus, in olden times, we find in Homer that Nestor used a poultice of onions, cheese and meal, mixed with wine to Machaon's wounds: and the former substance, a kind of which, under the name of "jangli pyáz," was shown in the Exhibition, was used by the ancient Egyptians in cases of dropsy. The hellebore of Anticyra was long extolled by the Greek writers,

and is said to have been used by MELAMPUS of Argos, to cure the daughter of KING PROCLUS of melancholy. It is stated in many books, that hellebore, under the name of "kala kootki," is used in India, but this has been found to be erroneous as far as the Punjab is concerned, since "kala kootki," is here applied to a different drug. It has also been supposed that opium was the Nepenthe of HOMER.

Enough has been adduced to prove the antiquity of those simples or Galenical preparations as medicinal drugs derived from the vegetable kingdom; and it is better next to consider in what manner the use of drugs was probably commenced. The use of each vegetable preparation was probably at first brought about by the experience of individuals, each of whom had found that certain plants were useful in the diseases which afflicted himself or his neighbours, and this knowledge was more rapidly spread owing to the ancient custom of placing the sick in public roads and markets, so that passers by might communicate information respecting such remedies as were employed in similar cases. As observed by HERODOTUS, in this way a knowledge of a great number of medicines would be gradually acquired; at first, chiefly of those which were indigenous to the country, but gradually, the drugs of other countries would become known, especially those which were found to be of undoubted efficacy in the disease for which they are used.

Hence it is to be expected that there will be found a larger number of substances, which are inert or nearly so in a Materia Medica which comprises indigenous plants only, than in a collection of drugs brought from a distance. Moreover, as the imported drugs must always be more costly than the indigenous ones, there will always be a tendency to substitute some indigenous substance which may resemble the foreign one in appearance or action, especially as the description of the drugs or of the plants from which they are derived, was formerly much less carefully attended to than now. Thus it will be seen, as above stated, that an Indian plant *Picrorhiza kurrooa* has been substituted from the more remote Hellebore of the Greek physicians.

Similarly a kind of *Valerian* takes the place of *Asarabacca*, and fruits of *Gardenia* that of the juniper. This substitution would certainly bring the kind of remedy in which it was employed into disrepute, as the substance used for adulteration would differ greatly from the original drug in its powers and mode of action.

Besides the above modes of ascertaining the natures of remedies, which being founded on actual experience, must be termed improved methods, there is another mode, already referred to, called the DOCTRINE OF SIGNATURES. This is founded on the belief that every natural substance possessed of medicinal virtues indicates by its external character the disease for which it should be employed. Thus turmeric, rhubarb, and other roots which have a brilliant yellow color, were supposed to be especially useful in jaundice and disease of the liver. *Cassia fistula*, "amaltás," from the peculiar septa of the fruit, resembling the valves of the intestines, is supposed to be especially destined for the cure of disease of these organs; and, similarly poppies, from the shape of their capsule, were supposed to be useful in diseases of the head; and roses, from the color of their petals, to the blood. Many small red or yellow seeds, especially those of Cruciferous plants, were supposed to be useful in cases of gravel, the deposit of which they somewhat resemble in appearance; and "sálap misri" is used in diseases of that organ, to which the name of *Orchis* (applied usually to the plant) is assigned; the convoluted pod of the *Helicteres Isora* is employed in cholic, since it is supposed to resemble the twisting of the coils of the intestines. But although it is probable that the use of different drugs was commenced in some of the ways already spoken of, yet at the present day the native physicians have adopted, with some modifications, the idea of GALEN respecting the method of operation of medicines; this was, that the uses of all medicines were derived from their elementary or cardinal properties,—namely, heat, cold, moisture and dryness; and that all diseases could also be classed under the above heads, but that in the treatment of disease a medicine should always be employed which was of a contrary nature to the disease treated; thus a cold disease requires a hot remedy, and the converse. It is probably that ignorance of the attachment to this theory, (which is well known to native patients and hakíms,) is often an obstacle to the employment of European medicines in the hands of European practitioners among natives, as either a remedy which they consider hot is employed for a disease which is also considered hot, or the prescriber does not state whether the remedy given is a hot or cold one even when asked. Although the theory that medicine acts by being hot or cold only is entirely erroneous, yet it has so strong a hold on the confidence of many natives that without some attention to it, it would be difficult in many cases to induce them to take the medicine ordered.

The following is a list of some of the drugs employed, showing their nature according to native ideas, and also the real use in European medicine.

Cold Medicines.

Scientific name.	Native name.	Use.
Phyllanthus emblica, ...	Amla, ...	Astringent and acid purgative.
Rosa, ...	Gul surkh, ...	Astringent.
Rosa, ...	Guláb, ...	Astringent and purgative.
Citrus aurantium, ...	Narangi, ...	Astringent, tonic.
Tamarindus indica, ...	Imlí, ...	Refrigerant.
Terminalia chebula, ...	Halela, ...	Astringent.
Rhus coriaria, ...	Samák, ...	Astringent.

Hot Medicines.

Semecarpus anacardium, ..	Bhiláwa, ...	Acrid.
Corylus avellana, ...	Findak, ...	Demulcent.
Dracocephalum Royleanum, ..	Bálangú, ...	Aromatic.
Zingiber officinale, ...	Sonth, ...	Aromatic.
Moschus, ...	Mushk, ...	Aromatic.
Aquillaria agallocha, ...	'U'd, ...	Tonic.
Caryophyllus aromatica, ...	Karanful, ...	Aromatic.
Amber, ...	Kahruba, ...	Tonic.
Narcissus tazetta, ...	Nargas, ...	Acrid.

Dry Medicines.

Prunella sp—, ...	Ustúkhúdús, ...	Aromatic.
Raw Silk, ...	Abresham, ...	Inert.
Centaurea Behmen, ...	Báhman, ...	Tonic.
Polypodium, ...	Bisfaij, ...	Tonic.
Dracocephalum Royleanum, ..	Bálangú, ...	Aromatic.
Psoralea corallifolia, ...	Bábchí, ...	Tonic.
Laurus cinnamomum, ...	Dárchíní, ...	Aromatic.
Laurus cassia, ...	Taj, ...	Aromatic.
Pastinaca, ...	Shakákul, ...	Demulcent.
Crocus sativus, ...	Zafrán, ...	Inert.
Mentha sativa, ...	Pudína, ...	Aromatic.
Myristica moschata, ...	Jaiphal, ...	Aromatic.

Moist Remedies.

Phyllanthus emblica, ...	Amla, ...	Astringent.
Tamarindus indica, ...	Imlí, ...	Purgative.
Silica, ...	Tabáshír, ...	Inert.
Vitis vinifera, ...	Zirishk, ...	Demulcent.
Camphora, ...	Káfúr, ...	Aromatic.
Onosma sp——, ...	Gauzabán, ...	Tonic.
Coriandrum sativum, ...	Dhanyáñ, ...	Aromatic.
Rosa, ...	Gul súrkh, ...	Astringent.
Nymphœa, ...	Nílofar, ...	Inert.
Citrus aurantium, ...	Narang, ...	Aromatic.

From the above list it will be seen that many of the cold remedies, are what are used in European therapeutics astringent medicines, while the hot remedies are principally aromatics; but that very various remedies are classed under the terms moist and dry.

The drugs are prepared for administration in comparatively few ways. The smaller seeds, &c., are usually given entire, but many others are reduced to powder by crushing them either with a large pestle and mortar, or in a mill. The powder is sometimes given by itself, at other times it is made into a confection, "májún," by mixing it with sugar or "gur," or in the hill districts, with honey; or the powder is mixed with gum water and made into a pill, "goli." Very often powders of several drugs are first mixed together, and then prepared for use in one of the above ways. If the drug is only intended for external application, the powder is either rubbed on the part alone or mixed with oil or butter to form an ointment, "mulaim;" sometimes wax is added, and thus a cerate is formed.

If the medicine is of great power, as in the case of "kúchila" (*Strychnos nux-vomica*), it is often first boiled in milk and allowed to soak for the space of a night, and thus part of the active principle is removed and poisonous effects are avoided.

When a liquid medicine is to be prepared, sometimes the drug is made into an infusion, "khesándah," either by simply steeping it in cold water for 8 or 12 hours, or by pouring boiling water over it and allowing it to cool.

At other times a decoction, "joshándah," is prepared, by boiling the medicine with water, which is poured on the drug at the ordinary temperature. In a few instances extracts are made by filtering the decoction and evaporating it to dryness; in this way "rasaunt" and "kath" are prepared. Another somewhat similar preparation is the extract made from plants which contain much starch, by boiling them for some time in water, thus dissolving the starch and straining off the woody matter, and then evaporating the decoction to dryness, thus "sat gilo" is prepared. But one of the most common methods of preparing medicines used by the natives is the distilled water called "'ark;" this is made by putting the powdered drug with water into a still, and then applying heat. The volatile constituents of the drug are alone drawn over. When the drug is an aromatic stimulant, the "'ark" must contain the most important part, but when as in other cases, the active principle of the drug is fixed, it is obvious that the "'ark" can possess no great efficiency.

The native hakíms do not employ alcohol in any form in the preparation of medicines, hence neither tinctures nor spirituous extracts are ever used by them, nor is acetic acid, in the form of vinegar, employed to extract the active principles of drugs; although occasionally used to form a sort of poultice with sugar. Linseed meal poultices are not used, nor in fact any other sort; and for blistering hot water is employed instead of cantharides. Plasters also are not used, or very rarely so.*

In describing the vegetable drugs, the following method has been adopted:—

1*st*. There is a systematic index, showing the various plants used,—arranged according to their natural orders, on De Candolle's system, each family of plants containing drug-herbs being described in detail.

The general vernacular index at the end of the volume will furnish a key to all synonyms, as well as to the botanic equivalent for any given native name.

THALAMIFLORÆ.

RANUNCULACEÆ.

1079. Delphinium sp——? *Vern.*—Isbarg.

(4528) Amritsar.

(4657) Peshawur.

The yellow flowers, dried: used as a dye. Consists of dried stalks, flowers, leaves and fruit, of a pale yellow color.

1080. Anemone sp——? *Vern.*—Brámi.

(2127) Lahore.

A much divided leaf, not in general use. Plants acrid and irritating; used as sialogogues and for gout and rheumatism.

1081. Nigella indica. *Vern.*—Kalonjah; kalungi; kálá zírah; siya dánah; tukhm-i-gandaná.

(645) Gurgaon.

(1150) Ambálah.

(1369) Amritsar.

(1211) Jálandhar.

(1454) Amritsar (*called probably by mistake* shauníz).

(1584) Gurdaspúr.

(1999) Lahore.

(2443) Kashmír (tukhm-i-gandná).

(2492) Nábhá.

(2297) Kashmír (siya dána).

Small triangular black aromatic seeds having internally a white albumen, which contains from 5 to 10 per cent. of oil.

It is considered by natives a warm dry medicine; used in phlegmatic and in cholic diseases, and all swellings. It assists digestion, but is principally

* HONIGBERGER describes a man who brought him a plaster made of litharge, which he brought from Bukhára, and was supposed to possess wonderful virtues.

used for horses. It is also used as a spice; and formerly was employed as a substitute for pepper. A stimulant aromatic tonic, useful in indigestion. It is believed to increase the secretion of milk, and to be useful in rheumatism, spleen diseases, and fever. It is also said to preserve woollen cloths and shawls from insects.*

Dose.—6 máshas, or from 10 to 30 grains. Price, a rupee a seer.

1082. Aconitum ferox, luridum, napellus, or palmatum.

(All these have similar properties, and are said to be mixed).

Vern.—Bish, bikh, bikhma, bishnák; ati singyá, míthá bish, míthá teliya, míthá zahr (míthá dodya, somewhat different), mishrí bish, muhúra, kala mohra, long teliya, singya jar, singya khár.

(765) Amritsar.
(685) Gurgaon (mitha mora).
(1724) Lahore.
(1079) Delhi (mítha dodya, a white variety).
(1658) Lahore.

A dark brown wrinkled conical root, with either a black or white centre, very brittle; contains much starch. Taste irritating and acrid, causing a persistent tingling sensation.

A virulent acronarcotic poison, containing from 50 to 90 grains of *Aconitine* in a pound. Of this alcaloid one-tenth of a grain may prove fatal. It produces tingling and numbness, debility and contraction of the pupil. Used by natives and Europeans in rheumatism and neuralgia, but seldom given internally; by the latter also employed in tetany, rheumatism, gout, and heart disease; also leprosy and cholera fever. It is a very valuable remedy, but requires great caution in its use.

It is said to turn black by being dipped in the urine of cows, but in reality it is torrefied.

Dose.—By the natives, a piece the size of a grain of "moth:" rarely used alone. Price, a rupee a seer.

1083. Aconitum heterophyllum. *Vern.*—Atís, patís, batís.

(1325A) Delhi.
(1300) Jálandhar.
(1726) Lahore.
(1727) Lahore (patís).
(5095) Simla (batís, a small variety).
(1209) Jálandhar.

Small irregularly conical ash-colored pieces, white internally; taste bitter, but not numbing. It contains much starch.

It contains no poisonous principle, but acts as a bitter tonic and febrifuge. Said to be pungent, astringent and heating.

Used by Europeans and natives in the treatment of fever, debility, and diarrhœa. Used by natives in debility, diabetes, gonorrhœa, gleet, hœmorrhoids, and irritability of the stomach; also to women after labor, or uterine hœmorrhage, mixed with others drugs; and in dyspepsia and dysentery: also employed as a tonic and in coughs.

Dose.—Half tolah, or from one drachm. Price, Rs. 1-4 a seer.

1084. Thalictrum foliosum. *Vern.*—Phalijarí, chitra múl, keraita, chera, chireta? chitra.

(1011) Delhi (in vernacular catalogue, phalli jarí?)
(1281) Jálandhar (chireta ?)
(1359) Hushyarpúr (cherayta).
(1522) Lahore (chitra).
(1228) Lahore (chitra múl).
(2475) Kashmír (chaihrá).

A yellow rhizome, with a circular concave basis of fistulous stems. It probably contains Berberine.

The roots are said to be substituted for rhubarb, in double doses. The *Thalictrum majus*, "poor man's rhubarb," is so used in England.

A bitter purgative and diuretic.*

Dose.—2 chitaks. Price, 5 annas a seer.

1085. Thalictrum? *Vern.*—Momírá, or mámírán.

(1948) Lahore.
(2349) Kashmír.

Small cylindrical roots, brown externally, with a yellow meditullium; resembles much the former, but is of a brighter color. There are two kinds, the small, which is the best, and a large sort. Very much valued by natives as an astringent application to the eyes in chronic opthalmia. In the Kashmír list it is called mámírán Chíní (or Chinese), and said to come from Yárkand. The "Makhzan ul Adwiya" says: there are three kinds—Hindí, Khurásáni, and Chíni. Hindí is blackish yellow in color; Chíní is dull yellow; Khurásáni is dark and greenish.

Called *Glaucium citrinum* by HONIGBERGER.

1086. Pœonia corallina. *Vern.*—'Ud sálap.

(1723) Lahore.

The Paonia παονια or Γλυκυσιδη of DIOSCORIDES.

Irregular, flattened, woody masses, with a brownish

* These seeds are liable to be confounded with kálí zírí (*Serratula anthelmentica*) or kala zira (*Carum nigrum*), which are also stimulant aromatics; or with káládána, which is a purgative.

* This root is liable to be confounded with charaita, a bitter tonic, or chitra, or lál chitra (*Plumbago zeylanica*); also chetra, stated to be a species of *Berberis*.

epidermis and fibrous coating, with numerous fissures radiating from the centre.

Used by natives for weakness, palpitation, and asthma; and to fasten round the neck of children to prevent asthma.

Root believed to be antispasmodic and to stimulate the secretion of milk and menses. It is said to become more efficacious the longer it is kept.

Dose.—1 másha. Price, Rs. 2-4 a seer.

MENISPERMACEÆ.

1087. Tinospora cordifolia. *Vern.*—Gilo, gulanch, gularich, gúrcha. *The extract,* sat gilo.

(646) Gurgaon.
(1030) Delhi.
(1188) Ludhiana.
(1203) Simla.
(1245) Jálandhar.
(1352) Hushyarpúr.
(1406) Amritsar.
(1576) Lahore.
(1684) Do. (Chúniân tahsil).
(1021A) Delhi.
(2184) Rawalpindi.
(2263) Dera Ghází Khán.
(2325) Kashmír.
(2479) Jhínd.
(2330) Kashmír.

A root covered with loose papery bark and wood, composed of distinct wedges, separated by depressed medullary rays.

Used by natives for colds and fever, in doses of 6 mashas, in cold infusion; also in leprosy and skin diseases. Contains much starch, and a bitter principle. A useful demulcent tonic; a substitute for calumba or *Cetraria* in the treatment of dyspepsia; also diuretic and febrifuge. Used in intermittent fevers, in which it is said only to diminish the cold stage; also in chronic rheumatism and debility after fever, and, as a general tonic. Said by some to be as powerful a febrifuge as Peruvian bark.

The extract of the root "sat gilo" is made by boiling the root 12 hours in water, then straining and removing the woody fibres, and evaporating the liquor to dryness. Said also to be made by squeezing out the juice of the cut root, adding water, allowing it to stand, and collecting and drying the sediment. The substance is white, very brittle, irregular lumps. Contains a large quantity of starch. Specimens were sent from—

(3) Pattiala.
(1996) Lahore.
(2300) Kashmír.

Used in fever and urinary disease.

1088. Cocculus villosus. *Vern.*—Páthá.

(2080) Lahore.

A broad stalked rotundate, cordate, reticulate,—veined leaf. Use not clearly known.

PAPAVERACEÆ.

1089. Papaver somniferum. *Vern.*—Post, koknár.

HEADS.

(1120) Delhi.
(1378) Amritsar (koknár).
(1250) Jálandhar.
(1590) Gurdaspúr.
(2312) Kashmír.

A whitish ovate capsule with a radiated sessile stigma, large parietal placenta, and small seeds; it contains both meconic acid and morphia, which are more abundant when not quite ripe.

Used as a narcotic by natives in cases of cough; also by Europeans, especially in diseases of children, also as a soothing external application for sprains, bruises, &c.

Dose.—1 chitak. Price, 4 annas a seer.

SEEDS. *Vern.*—Khash khás.

(1546) Amritsar (white seeds).
(1371A-1371 B) Amritsar (black seeds).
(1385) Pattiala.
(1283) Jálandhar.
(1021) Delhi.
(2211) Dera Ghází Khán.

The two kinds of seeds are believed to be either distinct species, or well marked varieties. The seeds are small, reniform, rugose, and very oily.

The natives consider the white as articles of food, but that the black are more powerful, and are used in coughs and special diseases.

Dose.—1 tolah. Price, 2 annas a seer.

In European practice the seeds are considered oily demulcents, and are not used alone.

POPPY OIL. *Vern.*—Khash khás ka tel.

(1366) Hushyarpúr.

OPIUM. *Vern.*—Afím, afyúm.

(1037) Delhi.
Pattiala.

Most of the specimens of opium were included in the intoxicating drugs.

There are said to be four kinds—"Chaum," white "maum," black; a yellow sort; "saurni," mixed.

On analysis of Punjab opium by DR. HAINES of Bombay in 1862, shows the following results:—

	Morphia. per cent.	Narcotine. per cent.	Water. per cent.
Punjab, No. 1, ...	4·44	3·17	8·73
„ No. 2, ...	9·26	2·73	8·67
Patna, 1850, ...	4·53	4·90	3·33

From this it is evident that the Punjab opium examined, was quite equal to the Patna, and the specimen No. 2, much superior.

Opium is most extensively used by the natives, especially in eye diseases; in which it is either applied with a pencil of antimony, or fixed on the temple with plaster. Its applications in disease are too numerous to detail. Opium, by Europeans, is considered a most valuable narcotic and anodyne. It at first acts as a stimulant, afterwards it relieves pain and produces sleep. It diminishes the secretion of the bowels and kidneys, but increases that of the skin; and therefore acts as a diaphoretic.

It is used in insanity and delirium tremens; also in peritonitis, ulcers of the stomach, diarrhœa, and dysentery. It is occasionally used in fevers, epilepsy, asthma, bronchitis, phthisis, and disease of the heart; also in cholera, strangulated hernia and calculus; in cancer and diseases of the ovaries and uterus, and in syphilis.

Price, 4 tolahs for the rupee.

1090. Argemone mexicana. *Vern.*—Siálkánta; bhatmíl; satya nasa; bherband.

(1026) Delhi.

A cylindrical four-valved thorny capsule, opening by valves at the apex. Said to be the "fico del inferno" of the Spaniards, who consider the seeds more narcotic than opium. The infusion is said to be diuretic, and the oil purgative: the juice is said to be a substitute for ipecacuanha. Requires further trial.

This plant is a native of Mexico, but is now found abundantly in Asia and Africa, over a very extended area. The stalks and leaves abound with a bitter yellow juice like gamboge, which is used in chronic opthalmia. The seeds are used in the West Indies as a substitute for ipecacuanha. An oil is also pressed from them, which in South America is much used by painters, and for giving a shining appearance to wood. It has also been employed as a substitute for castor oil, and is applied externally in headache by the native practitioners.

The juice of the plant in infusion is diuretic, relieves strangury from blisters and heals excoriations. The seeds are very narcotic, and said to be stronger than opium. SIMMONDS says, "the seeds possess an emetic quality. In stomach complaints, the usual dose of the oil is thirty drops, on a lump of sugar, and its effect is perfectly magical, relieving the pain instantaneously, throwing the patient into a profound refreshing sleep, and relieving the bowels." This valuable but neglected plant has been strongly recommended as an aperient anodyne, and hypnotic by DR. HAMILTON and other experienced practitioners in the West Indies.* Samples of the oil were produced at the Madras Exhibition. It is cheap and procurable in the bazars, being used chiefly for lamps. AINSLIE, LINDLEY, SIMMONDS, &c.†

ANONACEÆ.

1091. Anona squamosa. Custard apple. *Vern.*—Sharifa.

(1008A) Delhi.

Long conical brownish red seeds with a remarkably runcinated white albumen.

Are considered acrids, and used to destroy insects, hence the powdered seeds applied to the hair; also in itch. It is employed internally in depression of spirits, and spinal diseases.

1092. Guatteria longifolia. *Vern.*—Debdárú.

(1038) Delhi.

A white wood without bark.

MAGNOLIACEÆ.

1093. Illicium anisatum. *Vern.*—Badyán khataí.

(1014) Delhi.

(1972) Lahore.

(2388A) Kashmír.

(1234) Jálandhar.

Fruit star-shaped, of 6 to 10 rays, with deep red follicles, containing single oval seeds, taste aromatic. Seeds contain an essential oil.

Said to come from Khataí, or China: also, says the "Makhzan," from Naipál hills, and from a certain island called Zerbát, and to resemble anise in flavor and effect. Principally used in coughs and cold, and as a carminative in flatulency.

A warm aromatic stimulant: the oil is used largely in Europe as a substitute for anise, than which it remains fluid at a lower temperature.

Dose.—Of the fruits, 2 mashas. Price, Rs. 1-8 a seer.

1094. Michelia champaca. *Vern.*—Chamúti, champa.

(1344) Hushyarpúr.

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* *Vide* Pharmaceutical Journal Vols. VI., V., and XII.

† Drury's Useful Plants of India: *sub voce.* Argemone. The plant is not common in the Punjab, it is one of those species which are gradually extending their habitat; it is I believe to be seen up as far as Delhi.

Large flat oval legumes, with the hardened pericarp generally divided longitudinally; marked externally with white dots, each fruit contains two oval red seed.

The flowers and fruits used in dyspepsia. It is considered a bitter and cool remedy, useful in nausea, difficulty of passing urine, and fever. It acts as a tonic and antiperiodic in fever.

Dose.—Of the fruit, 1 masha. Price, 1 rupee per seer (where procurable).

FUMARIACEÆ.

1095. Fumaria parviflora. Fumitory. *Vern.*—Pápra; shítraj (Ar.); pit pápra; shahtara.

(1184) Ludhiana (pit pápra).
(1595) Gurdaspúr (shahtára).
(636) Gurgaon.
(1132) Hissar.
(1142) Ambálah.
(1266) Jálandhar.
(1137) Sirsa.
(1412) Amritsar.
(1728) Lahore (shítraj, Arab).
(2202) Gujrat.
(2239) Dera Ghází Khán (called surápis in the original list).
(2301) Kashmír.

Indigenous, common.

The dried herb, with much divided green leaves, wedge-shaped leaflets, and small flattened achenia on a raceme.

It is extensively employed as an anthelmintic, and is used by natives to purify the blood in skin diseases; also as a diuretic, diaphoretic, and aperient, and in mania. In Europe it was considered bitter, slightly diaphoretic and aperient; and was formerly used in diseases of the skin and liver, and in scrofulous affections, and especially in leprosy, herpes and scabes.

Dose.—2 chitaks. Price, 2 annas a seer.

CRUCIFERÆ.

1096. Cheiranthus cheiri. Wall-flower. *Vern.*—Todrí surkh or lál.

(978) Delhi.
(1500) Amritsar.
(1198) Lahore.
(2445) Kashmír.

Small linear acute reddish seeds. Flowers said to be cordiac and emmenagogue: used in paralysis.

1097. Cheiranthus annuus. Stock. *Vern.*—Náfarmání, todrí safaid.

(1510) Amritsar.
(1698-1714) Lahore (náfarmání).
(2428-4145) Kashmír.

Small disk-shaped white or reddish seeds with a membranous wing. Used as a tonic.

The natives state that there are five kinds of todrí seed, distinguished by the color of their flowers. Lal, or surkh, and zard, which appear to be wall-flower seeds; safaid, náfarmání and nílá, which are stock seed.

Dose.—2 máshas. Price, 12 annas a seer.

1098. Lepidium sativum. *Vern.*—Hálím, hálún, táratezak.

(632) Gurgaon.
(1090) Delhi.
(1130) Hissar.
(1567) Gurdaspúr.
(1256) Jálandhar.
(1420A-B) Amritsar.
(2211) Gujrát (hálún).
(1703) Lahore (táratezak).
(2437) Kashmír.
Pattiala.
(1958) Lahore (hálím, the dried plant).

Small ovoid reddish mucilaginous seeds. Action laxative and antiscorbutic. Used as an application to bruises and a tonic internally; in full doses a stimulant and aperient.

Considered by natives hot and dry; useful to remove hiccough and wind, and disorders of the blood; also in special diseases.

Dose.—3 máshas. Price, 2 annas a seer.

1099. Sisymbrium irio. *Vern.*—Khúb kalán; khákshí.

(638) Gurgaon.
(1084A Delhi.
(1132) Hissar.
(1164) Dera Ismael Khán.
(1462 Amritsar.
(1699) Lahore.
(2173) Rawalpindi.
(2208 Gujrát.
(2473) Kashmír (khákshí).
Pattiala.

Small oval bright yellow seeds. Used for coughs, but seldom. Formerly used as a pot-herb in England.

Dose.—3 máshas. Price, 8 annas a seer.

1100. Raphanus sativus. Radish. *Vern.*—Múli, tukhm-i-turb (Pers.).

(1162) Ambálah.
(1214) Jálandhar.
(1702) Lahore.
(2269) Dera Ghází Khán.
(2624) Gujrát.
(2452) Kashmir (tukhm turb).

Middle sized angular red seeds. The seeds act as diuretic and laxatives, and contain much oil. The

roots are diuretic and laxative. Used as a tonic in special diseases, and for calculus by the natives.

Dose.—1 tolah. Price, 4 annas a seer.

1101. Farsetia Hamiltonii. *Vern.*—Faríd bútí.

(1683) Lahore.

A common indigenous plant, rarely used in medicine. Leaves and stem glaucous pilose, with pink cruciferous flowers, and broad flattened siliquæ.

1102. Brassica? rapa. Turnip. *Vern.*—Shalgham (or shaljam, Pers.), gonglú.

(1311) Jálandhar.

(1373) Amritsar.

(1701) Lahore.

Pattiala.

Small globular brown or reddish seeds, containing much oil. Used as a tonic by natives.

Dose.—1 tolah. Price, 2 seers a rupee.

1103. Brassica oleracea. Cabbage. *Vern.*—Ságkarm or karamb.

(2449) Kashmír.

(2010) Lahore.

Seeds diuretic and laxative, also stomachic. The leaves form a very useful vegetable, and are said to be good applications to wounds, and in gout and rheumatism. The seeds are said to be used for expelling intestinal worms. The leaves are said to dispel intoxication and prolong life. (AINSLIE).

1104. Brassica eruca. *Vern.*—Tárámíra.

(1920) Lahore.

(1364) Hushyárpúr (tárámíra oil).

Rawalpindi.

(2439) Kashmír.

Brown or yellowish red, irregularly disk-shaped small seeds. Less pungent, but more oily than mustard. Chiefly used to make oil.

1105. Brassica campestris. (Sinapis alba, *Linn.*) White mustard. *Vern.*—Sarsoń, saroń: rai or (Pers.) sarshaf: khardal (Arabic).

(1042-1089) Delhi.

(1305) Jálandhar.

(1409) Amritsar.

Peshawar.

Middle sized bright yellow pungent seeds. They contain fixed oils, and an acrid principle called sulpho-sinapisine.

Less energetic than black mustard: used to make incantations by throwing it on fire; also as a rubefacient. Considered by natives hot and useful in disorders of the mouth and worm.

Used by Europeans as a rubefacient externally, and an emetic and purgative, internally: in large doses as a tonic, and stimulant in smaller ones. Principally used as an emetic in cases of poisoning, especially by opium and alcohol; also in apoplexy and epilepsy, as a tonic in dyspepsia and fevers.

Price, 3 annas a seer.

1106. Brassica juncea? (Sinapis nigra). Black mustard. *Vern.*—Rai, kálá sarsoń: saroń khardal (Arabic); sarshaf.

(1072) Delhi.

(1269) Jálandhar.

(1451) Amritsar.

(1700) Lahore.

(1949) Lahore.

(1198) Simla.

(1362) Hushyarpúr (the oil).

Irregular globular, very unequal brown or reddish seeds. They contain myronic acid, and an albuminous substance, called myrosine; these, when in solution are decomposed and form an acid volatile oil containing sulphur. They also contain fixed oil.

Seeds acrid, bitter, stimulant and diuretic; in large doses, emetic.

Both this and the former are used by natives in powder as rubefacients, and as tonics in phlegmatic diseases. The black rai is considered the strongest: both are hot and dry; useful in mucous and bilious disorders, and leprosy.

It is largely employed to form sinapisms, or mustard poultices; but these to be useful, should be made with cold water, as hot water coagulates the myrosine. Mustard poultices are largely employed in all cases of subacute inflammation, in many cerebral affections, as apoplexy and paralysis; also in cholic, coughs, and sore throat.

Dose.—1 másha. Price, 2 annas a seer.

DIPTEROCARPEÆ.

1107. Shorea robusta. *Vern.*—Rál safaid; dhamar (this word is not used in the Punjab).

(987) Delhi.

(1069) Delhi (rál kálá, rál siya).

Flat yellowish opaque pieces, with longitudinal ridges. Sometimes these are black or brown, and then the resin is called, "rál siya."

Used principally to form varnishes; but also applied to ulcers or chillblains, and taken internally in special diseases. It acts as a stimulant. By Europeans it is principally used to form plasters, and as an application to indolent ulcers; also occasionally as a styptic to wounds: it combines easily with litharge to form a plaster.

Dose.—7 máshas. Price, 8 annas a seer.

1108. Vateria indica. Copal. *Vern.*—Kahruba (this is properly applied to amber), sundras.

(1091) Delhi.

(1845) Lahore.

The resin which exudes from this tree is often substituted for amber, and is boiled with oil to prepare varnishes.

Used as a stimulant for rheumatism and chronic ulcers, and in special diseases.

It is said to resemble copal : while fluid it is called the Pœnæ varnish :* it is sometimes made into candles, which give a fine clear light, and diffuse an agreeable fragrance.

TERNSTROMEACEÆ.

1109. Cochlospermum gossypium.
Vern.—Katírá gond.
(1074) Delhi.
(1697) Lahore.
(2345) Kashmir.
(4170) Peshawar.

Used as a demulcent for coughs and special diseases, an excellent substitute for tragacanth.

Dose.—6 máshas. Price, 6 annas a seer.

BARRINGTONIACEÆ.

1110. Barringtonia acutangula. *Vern.*—Samundar phúl.
(1915) Lahore.

Root bitter: said to be similar to cinchona it its action ; but also to be cooling and aperient.

Seeds very warm and dry. Used as an aromatic in cholic and in parturition ; also in opthalmia.

Dose.—3 mashas. Price, 4 annas a seer.

1111. Careya arborea. *Vern.*—Vákamba.
(1965) Lahore.

XANTHOXYLACEÆ.

1112. Xanthoxylon hostile. *Vern.*—Tej bal ; kabába.
Hab. Hills, Kábul.
(2021) Lahore (kabába).
(1512) Amritsar.

Seeds are used as an aromatic tonic in fever, dyspepsia, cholera ; and the bark also.

The small branches are used as tooth-brushes : the larger ones to triturate the hemp plant ; also they are employed in toothache and catarrh. The capsules and seeds are said to intoxicate fish.

Dose.—Of seeds, 2 mashas. Price, 8 annas a seer.

NYMPHÆACEÆ.

1113. Nelumbium speciosum.
SEEDS. (*Vern*).—Kaul-dodah or kaṅwal-dodah ; kaṅwal gatha.
(679) Gurgaon (kanwal gatha).
(1060A) Delhi.
(1146) Ambálah.
(1182) Dera Ghází Khán (kawal doda).
(1289) Jálandhar.
(1416) Amritsar.
(1719) Lahore.
(2131) Kashmir.
Pattiala.

A large oval black seed, about the size of an olive. Both the seeds and roots are used by natives as food, either raw, roasted or boiled ; also as a cold remedy in cholera and indigestion. A demulcent, said also to be diuretic and cooling. (See No. 920, at p. 263 Class. III., Div. I., Sub-class (B)).

Dose.—3 mashas. Price, 2½ annas a seer.

STALKS OF ABOVE. Kaṅwal kukri ; kaṅwal gattha ; nalru ? bheng ?
(914) Dera Ghází Khán.
(1147) Ambálah.
(2017) Lahore.

Circular fistulous stems, divided by radiating membraneous septa.

Used in special diseases, and as a diuretic in dysuria.

1114. Nymphœa lotus. *Vern.*—Nilofar ; gulbar.
(641) Gurgaon.
(1186) Ludhiana.
(1139) Sirsa.
(1065A) Delhi.
(1219) Jálandhar.
(1415) Amritsar.
(1589) Gurdaspúr.
(1720) Lahore.
(913) Dera Ghází Khán.
(2199) Gujrát.
(2230) Muzaffargarh.
(2112-2522) Kashmir.
(2182) Jhínd.
Pattiala.

The halved dried flowers, consisting of numerous yellowish thin petals.

It is considered by native writers to be a dry and cold astringent remedy, used in fever and cholera, bilious affections and piles ; also in diarrhœa and eruptions of the mouth.

The root is mucilaginous and demulcent ; used in piles.

Dose.—1 másha. Price, 2 annas a seer.

FRUIT. *Vern.*—Nápá bij ; kumud bíj.
(1139) Sirsa.
(1121) Lahore.
(2163) Lahore.
(2431) Kashmir.

Used similarly. Considered by natives cool, and

* Sometimes written "Piney" varnish. The tree is called *Peinimarum* in Malabar, where it grows : hence the name.

used as an antidote for poisons; in skin diseases and leprosy.

Dose.—2 mashas. Price, 8 annas a seer.

1115. Euryale ferox. *Vern.*—Makháná phúl; makhána.

(1935) Lahore.

The seeds are baked and eaten by natives. They are considered strengthening, but are in reality only demulcent.

The drug is considered cool; useful in affections of the mind and special diseases; also after labor.

The seeds are farinaceous; they were reputed poisonous, but are not so really.

SAPINDACEÆ.

1116. Sapindus detergens or acuminatus. *Vern.*—Ritha; arítha; harítha.

(1102) Delhi.

(1294) Jálandhar.

(1492) Amritsar.

(1715-16). Lahore.

Used to wash clothes, as it forms a soapy admixture with water. In medicine, used externally to pimples and abscesses; internally in cases of headache; also in epilepsy and as an expectorant; if pounded and thrown into water it destroys fish. It is also recommended as an expectorant and for the cure of chlorosis; also to stop epileptic fits by placing its powder in the mouth.

1117. Cardiospermum Halicacabum. *Vern.*—Hab-ul-kalkal.

(1998) Lahore.

It is said to be useful as food: root aperient, juice a demulcent in gonorrhœa and in pulmonary affections. (AINSLIE.)

Used as a tonic in fever, and a diaphoretic in rheumatism.

Dose.—4 mashas. Rupees 2 a seer.

1118. Pavia indica. *Vern.*—Jauz mukaddar; bankhor.

(2466) Kashmír.

Used for horses in cholic. Recommended as an external application in rheumatism.

Dose—1 fruit. Price, 4 annas a seer.

BERBERIDEÆ.

1119. Berberis lycium (Asiatica or aristata). *Vern.*—Dár hald; chitra?

(1731) Lahore.

(1488) Amritsar.

A bright yellow fibrous wood: considered by natives hot and dry; useful in affections of the skin, eye, and ear. Lál chitra is often sent instead of berberis, but is at once distinguished by its pinkish color.

It contains an alcaloid berberine, which is of a bright red color, and very bitter.

EXTRACT OF BERBERIS. Rasauńt (called raswal in Múltan and elsewhere).

(1205) Simla.

(1291) Jálandhar.

(1013A) Delhi.

(1515) Amritsar.

(1728) Lahore.

(2289) Kashmír.

Pattiala.

A blackish red astringent extract, made by evaporating a decoction of the wood, containing much berberine.

A powerful astringent tonic; considered by some only second to quinine in fever, than which it is more diaphoretic; also extensively used externally in opthalmia, and internally in diarrhœa and dysentery; and in debility after fever and rheumatism.

It is a valuable application in opthalmia, if mixed with opium, alum and water, and dropped into the eye.

By natives it is used for opthalmia, piles, and inflammatory swelling: also in intermittent fever.

FRUIT. Zarishk talkh.

(1494) Amritsar.

(1734) Lahore.

(2289) Kashmír.

SEEDS. (Tukhm-i-gáwah-zimij).

(2434) Kashmír.

The berries form a useful astringent and refrigerant drink in fever.

CAPPARIDACEÆ.

1120. Capparis aphylla. *Vern.*—Karíl.

(1704) Lahore.

(1705) Lahore (pinjú).

Used occasionally as food.

Considered by natives hot and aperient, useful in boils, eruptions, swellings, as an antidote to poisons, and in piles; also in affections of the joints.

1121. Cleome pentaphylla. *Vern.*—Hul-hul ká bíj, chauni ajwain, bhangra: bhogra.

Considered by natives hot and pungent; useful in cholic, dropsy, ulcers, swellings, and leprosy: very beneficial in piles, and earache; also in convulsive affections and continued fever. Stimulant and sudorific; used in low fevers and rheumatism.

1122. Polynisia viscosa. *Vern.*—Dánad-bol; tukhm-i-kasús.

(679) Gurgaon.

(1706) Lahore.

(2045) Lahore.

(2247) Dera Ghází Khán (lúgan búti, the herb).
(1558) Gurdaspúr (called "harhar" in original Catalogue).

A counter irritant and vesicant. The root said to be a vermifuge. The seeds are considered carminative and anthelmintic. The juice of the leaves is useful in deafness. (AINSLIE).

VIOLACEÆ.

1123. Viola serpens. FLOWERS. Banafsha.

(1119) Delhi.
(1273) Jálandhar.
(1465) Amritsar.
(1696) Lahore.
(2179) Rawalpindi.
(2314-92) Kashmír.
(5091) Simla.
(85) Pattiala.

By hakims it is used as a diaphoretic, an aromatic, and laxative. Flowers used in Europe for their coloring matter. The seeds are said to assist the passage of gravel and calculi, probably on account of their resemblance in appearance.

ROOTS. Bekh banafsha.

(2392) Kashmír.

Said to be emetic in full doses, and to resemble ipecacuanha in its action; also to act as a purgative. It is said to contain an active principle, violine, resembling emetine, and to be especially useful in skin diseases of children.

Dose.—Half a drachm to a drachm.

1124. Oxalis corniculata. *Vern.*—Amlika; amrúl.

(2051) Lahore (plant).
(2429) Kashmír (tukhm-i-hummáz, seeds).
(2432) Kashmír (turshak, leaves).

A very acid plant, containing salts of oxalic acid; it acts as a refrigerent in fever, and an antiscorbutic. Its juice may be used to remove inkspots, as it rapidly dissolves most compounds of iron.

It is principally used in fever, as a refrigerent, and scurvy; also externally to remove warts, proud flesh, and fibres over the cornea.

LINACEÆ.

1125. Linum usitatissimum. *Vern.*—Alsi (bazr kaitán, Arabic).

(983) Delhi.
(1181) Ludhiana.
(1370) Amritsar.
(1762) Lahore.
(2276) Dera Ghází Khán.
(1258) Jálandhar.

Small flattened ovoid acute reddish seeds, very oily; shining dark brown on the surface, white within.

By natives it is considered hot, and used in phlegm. Very demulcent and oily; extensively used in powder, both in European and native practice, to make poultices; also taken internally in inflammatory affections, and in catarrh, diarrhœa, dysentery, visceral inflammation, and special diseases.

Poultices should be made by first adding a little of the linseed meal to a small quantity of hot water, and then alternately more water and more linseed meal, with constant stirring until the required thickness is obtained. They are principally used in abscesses to promote suppuration, and in inflammations of the chest, abdomen, and joints, to relieve pain.

TAMARICACEÆ.

1126. Tamarix gallica. *Vern.*—Pilchi.

(1788) Lahore.

The bark is bitter and astringent, and its ashes contain a large quantity of sulphate of soda.

1127. Tamarix dioica. *Vern.*—Jhau; farwáń; harwáń; farás.

(1936) Lahore.

Used for purifying the blood.

Dose.—6 mashas. Price, 1 anna a seer.

1128. Tamarix orientalis, galls of. *Vern.*—Máiń chote; and máiń barí; jhau phalli; said to be of *Tamarix furas.*

(1183) Ludhiana (jauphalli).
(1937-38) Lahore.

Considered by natives warm and dry. Used for dyeing and tanning; also as astringents in diarrhœa, dysentery, and mucous discharges; also affections of the throat. The largest are preferred.

Dose.—4 mashas. Price, 1 anna a seer.

MALVACEÆ.

1129. Malva rotundifolia.

SEEDS. Khubází.

(1047) Delhi.
(1392) Amritsar.
(1175) Ludhiana.
(1708-1980) Lahore.
(2198) Gújrat.
(2431) Kashmír.
(1212) Simla.
Pattiala.

FLOWERS. *Vern.*—Gul-khaira; kaugi?

(1121) Delhi (gul khubází).
(2027) Lahore (gul khaira).
(676) Gurgaon.
(1186) Ludhiana (gul khaira).
(978) Delhi? (todri).

LEAVES, called kangí ka ság.

Mucilaginous and emollient; used to form poultices; said to be inferior to *Althæa*. It is used internally by Europeans, though rarely, in inflammations of the lungs and bladder, and externally in skin diseases. By natives it is considered useful in piles; also in ulcerations of the bladder and cough.

1130. Althea rosea.

SEEDS. *Vern.*—Tukhm-khatmí.

(1095) Delhi.
(1215) Jálandhar.
(1143) Ambálah.
(1391) Amritsar.
(1710) Lahore.
(2197) Gújrat.
(2266) Dera Ghází Khán (tukhm gul khairá).
(2450) Kashmír.

ROOT. *Vern.*—Resha khatmí.

(1095) Delhi.
(1713) Lahore.
(1179) Ludhiana.
(1509) Amritsar.
(2290) Kashmir.
(2323) Kashmir (gul khatmí).
(1017) Delhi (gul khairá).
(1436) Amritsar (ditto).
(2027) Lahore (ditto).
(2232) Muzaffargarh (ditto).
(2251-2266) Dera Ghází Khán (ditto).

1131. Malva mauritiana? *Vern.*—Khatmí safaid.

(1217) Jálandhar.

It is considered by native druggists to be a very valuable demulcent, especially in affections of the chest. All the parts of this plant contain much mucilage, and acts as demulcents.

1132. Abutilon indicum. *Vern.*—Atipalá.

(2161) Lahore.
(2075) Lahore (khiratibalá).

The whole plant is mucilaginous and demulcent, and is a substitute for *Althæa*.

1133. Sida cordifolia. *Vern.*—Bijband; baryára.

(2125) Lahore.

Considered by natives as cool and dry. A useful demulcent in dysentery with rice; also in special diseases.

1134. Gossypium herbaceum. *Vern*—Kapás (the plant entire); banaula (seed); rúi pamba (cotton).

(1711) Lahore (banaula, seed).
(1711) Lahore (rúi.)
(1119A) Ludhiana (kapás ke patha).

Cotton consists of fine white tubular hairs, which become flattened and twisted on drying.

By Europeans it is used as an application to burns, and to cover over inflamed parts. The root and leaves are demulcent and tonic, and are used in Bengal in the treatment of fever and dysentery. The root is said to be emmenagogue, and to be useful in gravel and strangury. By natives the seeds are said to be moist, and to increase the secretion of milk and bile; also to cure epilepsy and thrush; and to be an antidote to narcotic poison. The wool is said to cure headache and disorders of the head, by removing offensive matter if stuffed into the nose.

1135. Abelmoschus moschatus. *Vern.*—Hab-ul-mushk.

(1124) Delhi.
(1334) Jálandhar (mushk).

Action: cordial and stomachic: said to be an antidote for the bites of serpents; also an emetic, and used in chronic dyspepsia. In Arabia it is said to be used to give a musky odour to coffee. (LINDLEY).

1136. Hibiscus cannabinus. *Vern.*—Sanní ka bij.

(1036) Delhi (tukhm-i-bhang).

Demulcent. Fibres used for cordage; fruit said to be acidulous.

1137. Hibiscus mutabilis. *Vern.*—Shálapápra (Hindi).

(2115) Lahore.

Demulcent.

1138. Hibiscus, red. *Vern.*—Rakt japa (Hind.).

(2095) Lahore.

The leaves are emollient and useful in strangury. The root is used in menorrhagia, and the flowers are employed to give a red color to spirituous liquors. (AINSLIE).

1139. Hibiscus, white. *Vern.*—Shwet japá (Hindi).

(2056) Lahore.

Flowers astringent.

1140. Hibiscus striatiflorus, blue. *Vern.*—Nil japa (Hindi).

(2055) Lahore.

Demulcent. Rarely used in Hindústaní medicine.

BYTTNERIACEÆ.

1141. Bombax heptaphyllum.

ROOT. *Vern.*—Músli sembal, músli safaid.

(688) Gurgaon.
(1946) Lahore.
(1933) Lahore (músli safaid).

There are three sorts of mooslie root represented in the Exhibition. Músli sembal, above mentioned; músli safaid, which is apparently an immature specimen of satáwar (*Asparagus ascendens*) and músli siyah.

Músli sembal is a light woody fibrous root, of a brownish color, with a thin epidermis, easily detached, and a very fibrous thick tuber. It acts as a stimulant and tonic, and some consider it in large doses, emetic. It is said to contain 10 per cent. of resin.

Dose.—6 mashas. Price 8 annas per seer.

LEAVES. Shálmali (Sanskrit).

(2113) Lahore.

The root of the sembal is supposed by natives to have great power in preventing the access of old age, if taken daily, and no acid swallowed.

1142. Mocharas. Gum resin.

(1093) Delhi.
(664) Gurgaon.
(1312) Jálandhar.
(1356) Hushyarpúr.
(1934) Lahore.
(2352) Kashmir.
Pattiála.

A reddish brittle gum. It is sometimes stated to be derived from the *Moringa pterygosperma*. Considered by the natives a temperate remedy: used as an astringent in diarrhœa and special diseases; also for pain in the loins and cholic. Usually given moist.

Dose.—6 mashas. Price, 6 annas a seer.

1143. Helicteres isora. *Vern.* — Maror phalli; marorí.

(1931) Lahore.
(931) Delhi (marorí).

A capsule composed of five long cells, twisted in a spiral manner, round the axis, each containing numerous small seeds.

Used in cholic, because, according to the doctrine of signatures, it is supposed to resemble the convolutions of the intestines; also, for a similar reason, it is used in diarrhœa and griping pains.

Said by natives to be hot and dry. Useful in indigestion and flatulency; also in swellings from cold and itch, and as an application to sores in the ears.

Dose.—2 mashas. Price, 4 annas a seer.

1144. Helicteres scabra. *Vern.*—Paphli.

(1932) Lahore.

No specimen was found in the Exhibition collection. Used in special diseases.

1145. Pentapetes Phœnicea. *Vern.*—Dopahrya; bandhúk (Hind.).

(1707) Lahore.
(2148) Lahore (bandhúk).

Considered by natives astringent. Flowers yield a mucilaginous refrigerent juice, used in special diseases, and in disorders of rheum and bile.

1146. Eriodendron anfructuosum. *Vern.*—Safaid sembhal ka phál.

(979) Delhi.

The hardened flowers, with the woody four-lobed calyx, the dried thin red petals, and numerous stamens.

1147. Sterculia sp—. *Vern.*—Pryango.

(2060) Lahore.

Leaves considered aperient, and a decoction of the fruit mucilaginous and astringent, and is useful in rheumatism.

MALPHIGHIACEAE.

1148. Hiptage madablota. *Vern.*—Madmaltí.

(2097) Lahore.

Leaves.

TILIACEÆ.

1149. Corchorus olitorius, depressus, acutangula, and other species. *Vern.*—Bahúphall; bophalli; banphal; babúna? karond?

(665) Gurgaon.
(1791) Lahore.
(1121) Hissar (karond).
(2189) Gujrát (babúnah).
(2258) Dera Ghází Khán.
(2190) Gujrát (bahúphallí).
(1251) Jálandhar (Ispand).

Considered by the natives a cold remedy. Used in special diseases, and also eaten as a vegetable Leaves emollient. Infusion used as a fever drink. The bark is fibrous, and is used to make rope.

Dose.—6 mashas. Price, 4 annas a seer.

1150. Grewia asiatica. *Vern.*—Fálsa.

(2157) Lahore (phalsa).

There are two kinds—one sweet, called "shakari," the other acid, "sharbatí." It is said to be astringent and to allay thirst, and strengthen the stomach. Its sherbet is useful in fever and indigestion.

GUTTIFERÆ.

1151. Garcinia. *Spec. incert.* *Vern.*—'Usárah rewand.

(1088) Delhi.

Considered by the natives a warm purgative, and used in indigestion, constipation, and also as a paint. It contains a yellow resinous acid, cambogic acid, and some gum. Extensively used as a valuable hydragogue cathartic in dropsy and obstinate constipation; also in brain diseases and tape worm.

Dose.—Grains 1 to 5. Price, Rs. 2 a seer.

1152. Mesua ferra. *Vern.*—Nágkesar.

(1081) Delhi.
(1718) Lahore.

Dried buds. Considered a temperate remedy. Used in coughs, especially when attended with much expectoration.

Dose.—2 mashas. Price, Rs. 1 a seer.

AURANTIACEÆ.

1153. Feronia elephantum. *Vern.*—Kath bel.

(1024A) Delhi.

(2085) Lahore (kaith pathá).

Very aromatic. Used as a stomachic stimulant in diseases of children. Both leaves and flowers are said to smell like anise. It yields a gum resembling gum Arabic, which acts as a demulcent.

1154. Ægle marmelos. Wood apple. *Vern.*—Bel; belgiri.

(675) Gurgaon.

(992) Delhi.

(1196) Simla.

(1264) Jálandhar.

(1375) Amritsar.

(1737) Lahore.

(2411) Kashmír (kath bil).

Simla.

The bark of the root and stem and the leaves are used as tonics in fever. The cut fruit, unripe, but dried, is a useful remedy in diarrhœa and dysentery. It contains tannic acid, a balsam gum, sugar, and a vegetable acid. It is said to act both as an astringent in diarrhœa, and its pulp as a laxative in constipation. It is considered by natives to be hot and moist, and to be useful in dysentery and diarrhœa.

Dose.—6 mashas. Price, 4 annas a seer.

1155. Citrus aurantium. Orange Peel. *Vern.*—Post turanj; sangtara.

(1736) Lahore.

(1026) Delhi (variety) post sangtara. This is considered the best kind.

(1433) Amritsar.

An aromatic tonic, containing tannic acid in the peel, and citric acid in the juice. Orange peel is used by the natives as a tonic in indigestion and palpitation. By Europeans it is employed as a tonic in fever and dyspepsia: the juice also in scurvy.

Dose.—2 mashas. Price, 2 annas a seer.

1156. Citrus decumana. *Vern.*—Mahá nimbu.

(2059) Lahore.

Fruit large, nutritive, and refrigerant. It contains sugar and citric acid, with much essential oil in the peel. The leaves of this and the orange are said to be useful in epilepsy, chorea and convulsive cough.

1157. Citrus limonum. *Vern.*—Nimbú, jambira.

(1028) Delhi.

SEEDS.—Karnah.

(1738) Lahore.

(1553) Amritsar.

(2096) Lahore (broish), (Hindí).

LEAVES.—Yúthika (Hindí), barg amrit phal.

(2147) Lahore.

The rind has a thin yellow surface, dotted with transparent vesicles, containing aromatic oil; it contains volatile oil, bitter extractive gallic acid, and hesperine. Used as a febrifuge. The peel is aromatic, bitter, and stimulant; the juice contains much citric acid, and acts as a refrigerent and antiscorbutic, and is largely used in scurvy and acute rheumatism, also for fevers, and occasionally in dysentery. It is said to be of service as an antidote to acronarcotic poisons. Considered by natives an antidote to animal poisons.

Dose.—Of the juice, 1 to 2 ounces.

CEDRELACEÆ.

1158. Cedrela toona. *Vern.*—Tun.

(1029) Delhi (unripe flowers).

(1071) Lahore.

Bark very astringent; used in diarrhœa and dysentery. Seeds sometimes used in fevers as a tonic; also the flowers are employed as a yellow dye, and the seeds to dye red.

GERANIACEÆ.

1159. Geranium nodosum. *Vern.*—Bhánd.

(2395) Kashmír.

Said to be astringent and useful in diseases of the kidneys.

VITACEÆ.

1160. Vitis vinifera. Grapes, raisins. *Vern.*—Kishmish; munakka; dákh.

(1733) Lahore (kishmish).

(1085A) Delhi.

(1732) Lahore (munakka).

(1495) Amritsar (zirishk shirin).

(1735) Lahore (dakh, seeds).

The pale raisins are said to be dried in the shade, the darker ones in the sun. Considered by natives cool and aperient. Used in coughs with great expectoration, and in catarrh and jaundice. Occasionally employed as a refrigerent in fever. They contain grape sugar and bitartrate of potash.

Dose.—20 fruits. Price, 4 annas a seer.

The grape seeds are employed as an astringent in diarrhœa.

Dose.—2 mashas.

GRAPE VINEGAR. *Vern.*—Augúr ki sirtha.

(2476) Kashmír.

The expressed juice kept partly exposed in the air till it ferments. It generally contains from 1 to 3 per cent. of anhydrous acetic acid. Used as an acid drink in indigestion and cholic; and sometimes in cholera; also mixed with salt as an emetic.

Dose.—5 tolahs; or as an emetic, 2 chitaks.

ZYGOPHYLLACEÆ.

1161. Tribulus lanuginosus and terrestris. *Vern.*—Kántaphal; khar-i-khushk (Persian); gokrukhurd; bhakra; pakra; phaugra.

(661) Gurgaon.
(1006) Delhi.
(1145) Ambálah.
(1221) Jálandhar.
(1578) Gurdaspúr.
(2212) Jhilam.
(2225) Shahpúr.
(1376) Amritsar.
(1761) Lahore.
(2177) Rawalpindi.
(2241) Dera Ghází Khán. (Gákrá) (*sic* in original list).
(2030) Lahore (phaugra).
(2471-2474) Kashmir.

This indigenous plant is considered cold by natives, and used in special diseases. Considered a mucilaginous diuretic. Used in diseases of kidneys, suppression of urine, and calculus; also in cough and and diseases of the heart. The herb is said to be astringent and vermifuge, and the seeds cordial.

Dose.—6 mashas.

1162. Peganum harmala. *Vern.*—Hármul; Isband; Isband Lahori?

(1760-1171) Ludhiana.
(1394) Amritsar.
Kashmir.
(2231) Muzaffargarh.
(641) Gurgaon (Isband).
(1251) Jalandhar (ditto).
(2203) Gujrát. (ditto).
(1038A) Delhi (ditto).
Patiala.
(1559) Gurdaspúr (called harhar: *this is probably a mistake*).

An indigenous and abundant plant. Principally used as a fumagatory agent to avert evil influences, especially when any person is present suffering from wounds, ulcers or abscesses. Also used in special diseases and in weakness of sight and retention of urine. The plant is considered proper only for sweepers, and not to be touched by Sikhs or Hindús; but the seeds are burned on a fire if any person enters a room who may have any discharge which could render him unclean.

Dose.—2 mashas. Price, 1 anna a seer.

1163. Fagonia cretica. *Vern.*—Bádawurd; damáhán (or perhaps more properly dam-áhár: both these names, the one in Hindi the other in Persian, mean "carried by the wind.")

(1792) Lahore (damáhán).
(1399) Amritsar.
(1184) Ludhiana.
(942) Dera Ghází Khán.
(1796) Lahore.

Used principally for purifying the blood. An indigenous plant, said to be hot and dry. Useful as an application to tumours; also in chronic fever, dropsy, and delirium, and in any disorder which arises from poisoning.

Dose.—6 mashas. Price, 1 anna a seer.

RUTACEÆ.

1164. Ruta augustifolia. Rue. *Vern.*—Sudáb; katmal.

(1758) Lahore.

The leaves contain a quantity of an acrid volatile oil and bitter extractive matter. Used by natives in a peculiar rheumatic pain, called "rhí," caused by exposure to draught. It also acts as an emmenagogue, and in pregnancy causes abortion.

Dose.—2 mashas.

Employed by Europeans as stimulant, narcotic, and antispasmodic, particularly in hysteria, cholic, and in uterine affections; and to destroy intestinal worms. Externally it acts as a rubefacient.

Dose.—10 to 30 grains.

MELIACEÆ.

1165. Melia azadirachta. *Vern.*—Mahánim; bukhain; drekh; the fruit is called darkonah.

(1003) Delhi.
(1743) Lahore (drekh).
(1103) Delhi (bukhain).
(1742) Lahore.
(1745) Lahore.

Said to be cool, dry, and bitter. Useful for gravel, piles, and lumbago; also to cure leprosy and diseases of the skin and boils. The seeds also are used to destroy vermin. It is said that the wood is not attacked by insects.

1166. Azadirachta indica. *Vern.*—Nim.

(977) Delhi.
(1035) Delhi (seeds, tukhm nim).
(1255) Jalandhar.
(1372-1423) Amritsar.
(1744) Lahore.
(2423) Kashmir.

The leaves are used externally as an application to leech bites and blisters, &c.; also by the natives they are taken internally for the purpose of purifying the blood, and curing skin diseases, especially leprosy and fever. The infusion of the leaves is used to wash ulcers. The bark is a valuable astringent tonic; useful in fever as a substitute for cinchona. It is considered by the natives cool and bitter, useful in eruptions and leprosy; also as an application to ulcers and boils:

also a decoction is useful as a wash for the hair, which it is said to darken, and to cure skin diseases, especially scabies.

Dose.—6 mashas. Price, 2 annas a seer.

AMYRIDACEÆ.

1167. Amyris commiphora.* *Vern.*—Gúgal; mukal.

(1073) Delhi.

(1741) Lahore.

The power of this remedy is considered to be increased by the number of blows, with a heavy pestle, that it receives. If one and a half lakhs of blows be given, it is considered a most valuable remedy especially for piles. It is also used as a fumigatory agent.

Dose.—1 masha. Price, from 6 annas to 1 rupee a seer, in proportion to the number of blows which it has received.

1168. Boswellia thurifera. *Vern.*—Kundar.

(1180) Delhi (lúbán ?)

Pattiala.

Used for incense; also as a stimulant astringent, and diaphoretic in affections of the chest. Considered by natives hot and dry; useful as a tonic to the stomach and brain.

1169. Balsamodendron gileadense. *Vern.*—Tukhm-i-balsán.

(1763) Lahore.

The balsam is considered a panacea.

CORIARIACEÆ.

1170. Coriaria Nepalensis. *Vern.*—Majári.

(1005) Delhi.

Leaves used for dyeing and tanning, and sometimes to adulterate senna, but is a dangerous poison in large doses. The fruit said to produce symptoms like tetanus.

AQUILARIACEÆ.

1171. Euonymus tingens? *Vern.*—Torud gopa.

(1040) Delhi.

Said to be really prepared from the dung of cows, which have been fed on "kesú," the flowers of the *Butea frondosa*. Used in opthalmia, and to make the "*tika*" on the forehead.

CELASTRACEÆ.

1172. Celastrus paniculatus. *Vern.*—Málkangani.

(667) Gurgaon.

(976) Delhi.

(1347) Hushyarpúr.

(1559) Amritsar.

(1592) Gurdaspúr.

(1837) Lahore.

(2351) Kashmír.

(2508) Lahore (leaves, kutaj ka patta).

(2138) Lahore (katahar).

A warm and dry remedy; principally used for horses, and for rheumatism, paralysis and special diseases. Acts as a powerful diaphoretic and tonic. Used to form the Oleum nigrum, a stimulant diaphoretic used in Beriberi. This oil is made by putting the seeds of *Celastrus nutans* with benzoin, cloves, nutmegs and mace into a perforated earthen pot, and then obtaining by a kind of *destillatio per descensum*, into another pot below, a black empyreumatic oil.

Dose.—1 masha. Price, 2 annas a seer.

MORINGACEÆ.

1173. Hyperanthera pterygosperma. *Vern.*—Sohánjná; sohanjna.

(1283) Jálandhar.

(1695) Lahore (bark).

Considered by natives hot. Used as a cold infusion in diarrhœa, and to purify the flood; also in affections of the eyes and diarrhœa; also eruptions and boils. The leaves, flowers, and pods are eaten. The roots resemble those of horse-radish, and are used in paralysis, epilepsy, and hysteria; also in fever. The wood is said to be employed to dye a blue color in Jamaica. The fruit is used by hakíms in affections of the liver and spleen, tetanus, debility of nerves, paralysis, pustules, and Indian leprosy.

PORTULACACEÆ.

1174. Portulaca oleracea. *Vern.*—Kulfa; lúniya; kundar?

(634) Gurgaon.

(1140) Ludhiana.

(1398) Amritsar.

(1591) Gurdaspúr.

(1235) Jálandhar.

(1764) Lahore.

(2196) Gujrát.

(2471) Kashmír.

Pattiala.

(2285) Kashmír (entered as "dhanni" in the Catalogue).

(2104) Lahore.

(1969) Lahore (the herb, lúnak ság).

Herb used for eating; acts as a refrigerent and alternative in scurvy and liver disease. Seeds said to be vermifuge. Considered by natives cool and

* For a particular account of these resins and balsams, see under the Class Gums and Resins.

dry; also aperient. Useful in disorders of mucus and difficulty of breathing and fevers. By hakíms, in inflammation of the stomach and ulcerations of the intestines (HONIGBERGER); also as an external application for erysipelas, and a diuretic in dysentery (AINSLIE). Applied to the temples it allays headache and heat; and internally it stops spitting of blood.

SIMARUBACEÆ.

1175. Nima quassides.

(1715) Lahore (*faringi*).

(2417) Kashmir (baringi).

Said to be hot and dry, and very bitter. Used in fever, indigestion, and difficulty of breathing. Used as a substitute for quassia as a useful tonic in fever.

FICOIDEÆ.

1176. Glinus litoides. *Vern.*—Zakhm-hayát.

(1970) Lahore.

The well-known creeper *Lettsomia* is also called zakhm-ul-hayát.

CALYCIFLORÆ.

RHAMNACEÆ.

1177. Zizyphus jujuba. *Vern.*—Ber; 'unáb.

FRUIT.—Kokanber, kuchra; seed or stone, kinár ke bij.

(1112) Delhi.

(1468) Amritsar.

(1835) Lahore.

(2183) Rawalpindi.

(2238) Kashmír.

(1020A) Delhi (kinár ká bij, or hal ká bij).

(1835) Lahore (kokanber, the wild fruit).

Red wrinkled dry drupes, the size of a nut.

BARK OF THE TREE.—Post-i-ber; ber ká chil.

(1057-1062) Delhi.

(1368) Amritsar.

(2419) Kashmír.

DRIED LEAVES.—Barg-i-unáb.

(2420) Kashmír.

The fruit called jujube is said to be nourishing, mawkish, mucilaginous, pectoral, and styptic.

The berries are considered by natives to purify the blood, increasing its quantity and converting black blood to red; and to assist digestion. The best comes from Kandahár.

Dose.—9 fruits. Price, 8 annas a seer.

The bark is said to be a remedy for diarrhœa: it contains much tannic acid, and a peculiar acid, called zygophic.

Dose.—6 máshas. Price, 1 anna a seer.

The small wild fruit, kokanber, is used in special diseases. The fruit if eaten after a meal is said to improve digestion and produce corpulency.

The root is said to be used as a decoction in fever; and also powdered to be applied to ulcers and old wounds; also in delirium. The leaves are used to polish gems, and to form a plaster in strangury and other diseases.

The seeds are used as astringents in diarrhœa.

1178. Zizyphus nummularia. *Vern.*—Ber; mallán; jhar-berí.

(1248) Jálandhar (fruit).

(1836) Lahore.

A small red drupe the size of a pea: use similar to the "unab." Considered by natives cool and astringent: useful in bilious affections.

AQUILLARIACEÆ.

1179. Aquillaria agallocha. Aloe wood or Eagle wood. *Vern.*—'Ud; 'úd fársi; agar.

(1020) Delhi.

(1994) Lahore.

A yellowish white, rather hard wood, with a pleasant smell.

It is said to owe its fragrance to the rotting of the wood, and the best specimens are therefore buried in earth for some time. They sink in water. It contains an aromatic resin, and is used as a stimulant and cordial in gout and rheumatism, and paralysis; also as a stimulant astringent in diarrhœa and vomiting. Its name, aloe wood, has nothing to do with aloes, but is a corruption of the Arabic term, Al-'úd. Formerly much used in Europe in gout, rheumatism, diarrhœa, vomiting and palsy. It is stated that in Siam the wood is obtained from hollow trees, of which it forms the heart-wood, the sap wood is much lighter and weaker in odour. Some consider that this wood is obtained from the *Alœxylon agallochum*, a leguminous plant growing in Cochin China: it is called Lign aloes.

TEREBINTHACEÆ.

1180. Pistacia vera. Pistachio nut.

FRUIT.—Pista; fistak (Arab).

(1752) Lahore.

GALLS.—Gul-i-pista; pista ka phúl.

BARK.—Post bírún-i-pista; chilka-i-pista (shells of the nut).

(1051) Dehli.

(1753) Lahore.

(1751) Lahore.

(2387) Kashmír.

The fruit is considered a warm and moist remedy, the kernel contains much oil and acts as a demulcent

and restorative. It is principally used in special diseases.

Dose.—6 máshas. Price, 1 rupee a seer.

The bark is employed as a tonic in indigestion.

The galls act as astringents and are used in diarrhœa.

Price, 1 rupee a seer.

1181. Pistacia lentiscus. Mastic. *Vern.*—Mustaki rúmí.

(1083) Delhi.

(1976) Lahore.

A yellow gum resin in small roundish semitransparent tears: used in native medicine for indigestion and diarrhœa, also as a local application for toothache: principally used in England as an astringent in excessive discharges, and to stop carious teeth; it has also diuretic properties, but is much inferior to turpentine.

It is used by hakíms in diseases of the stomach or liver; also as a masticatory. It comes from Kábul but the best is said to come from Turkey and the Levant, hence called "rúmi."

Dose.—Grains 20 to 40.

1182. Pistacia terebinthinus? *Vern.*—Hab ul-khizra.

(1680) Lahore.

Small brown dried fruits. Said to come from Bukhára, and to be used as an astringent in special diseases, and for palpitation of the heart.

This tree is said to produce cypress or Chian turpentine, and to supply a kind of follicular gall (*vide* supra).

Price, Rs. 2-8 a seer.

1183. Buchanania latifolia? *Vern.*—Nakl-khwája.

(1757) Lahore.

Used for glandular swellings of the neck.

Dose.—7 máshas. Price, 8 annas a seer.

1184. Semecarpus anacardium. *Vern.*—Bhela; bhiládar or bhiláwár.

(1114) Delhi.

(1204) Simla.

(1754) Lahore.

(1377) Amritsar.

Considered by the natives a very warm, dry and acrid remedy, principally used for horses, or for men suffering from paralysis. It is also considered that if a child commences with a daily dose of 3 máshas, and gradually increases this to 1 tolah weight, he will always be free from coughs and colds, and his hair will never turn white even in old age.

It is also supposed by natives to be useful in dropsy, fever, piles, diarrhœa and leprosy, and if it agrees with the patient, it is very efficacious, but otherwise, very prejudicial: also used in epilepsy, catalepsy and shortness of memory; and its juice is used in ring-worm and rheumatic pains. With lime water it is used to mark linen cloths.

The expressed oil is used also in paralysis and anæsthesia.

Price of seeds, 2 annas a seer.

It is a very acrid and poisonous substance, but if roasted the acridity is dissipated and the receptacles are then sometimes eaten as fruit. Probably would be useful in chronic rheumatism. The fruit is said to be eaten when green, and the juice of the dried nut to be used as an escharotic, or given internally in syphilis.

1185. Pistacia integerrima or Rhus acuminata.—*Vern.*—Kakar singhí.

(1803) Jálandhar.

(1354) Hushyarpúr.

(1756) Lahore.

(1032A) Delhi.

(2326) Kashmír.

(5090) Simla.

Pattiala.

A large hollow horn-like curved gall, with a tawny brown rough exterior.

It is considered hot, dry and astringent, and is used by natives in coughs and asthma, fever, piles and dysentery. It is also said to allay vomiting, thirst, and difficulty of breathing.

Dose.—3 máshas. Price, 6 annas a seer.

1186. Balsamodendron myrrha. *Vern.*—Bol.

It contains gum and resin, and acts as a stimulant expectorant. It is principally used in bronchitis, asthma and diseases of women; also as an external application to ulcers and sore throats, aphthæ and spongy gums: it acts as a stimulant and expectorant, also tonic and antispasmodic. By hakims it is employed in chronic coughs, induration of the liver, intestinal worms and amenorrhœa. It is said to cause abortion.

Dose.—10 to 30 grains.

1187. Mangifera indica. Mango. *Vern.*—A'm.

KERNEL.—Am ki bijli, ám ki gutli.

(1053) Delhi.

(1185) Dera Ghází Khán.

(1232) Jálandhar.

(1746) Lahore.

PEEL, DRIED.—Am chor; ám khushk.

(1402) Jálandhar.

(1747) Lahore.

Stone oblong, yellow, rough, fibrous, celled, with

two woody valves. The peel is used as a stimulant tonic in indigestion; it is also astringent.

The fruit is much eaten, and is used for an aperient in constipation, and a tonic: as the fruit is somewhat of the shape of a kidney, it is said to be useful for stone and diseases of the bladder. The kernels are said to be useful in expelling intestinal worms; also to arrest bleeding from piles and menorrhagia, and in diarrhœa as an astringent, and as a tonic in fever. The fruit of the mango contains much acid and turpentine, it therefore acts as a diaphoretic and refrigerent, and may prove useful in diseases of the urinary organs.

Dose.—6 máshas. Price, 4 annas a seer.

1188. Rhus coriaria. Sumach nut. *Vern.* —Sumák; tantri.

(1301) Jálandhar.
(1754) Lahore.
(18A) Pattiala.

Used by natives in cholera and indigestion. The leaves are extensively used in England for tanning purposes.

1189. Rhus parviflora ? *Vern.*—Samák.

(2304) Kashmir.

1190. Rhus sp——. *Vern.*—Tukhm dhalyáñ.

(2187) Rawalpindi.

LEGUMINOSÆ.

1191. Jonesia asoka. *Vern.*—Asog.

(2149) Lahore.

Not commonly used in the Punjab.

1192. Trigonella fœnumgrœcum. Fenugreek. *Vern.*—Methí; shamlit.

(642) Gurgaon.
(1038) Dera Ghází Khán.
(1933) Delhi.
(1182) Ludhiana.
(1229) Jálandhar.
(1147) Ambálah.
(1417) Amritsar.
(1816) Lahore.
(2210) Gújrat.
(2216) Jhilam.
(2438) Kashmír.
(2493) Jhind (tukhm bahal).
(1819) Lahore.

Seeds yellow, small, ovate, wrinkled, the radicle forming a prominent ridge divided by a furrow from the rest of the seed. It is considered by natives hot and dry, it removes costiveness, and is a vermifuge. The seeds are employed as tonics and demulcents in dysentery, cough, and special diseases. They are also used as coffee after roasting, and to form a yellow dye; and are said to be emmenagogue. The leaves are eaten as a vegetable. In English medicine the seeds are only employed as a demulcent and in poultices.

Dose.—6 máshas. Price, 1 anna.

1193. Psoralea corylifolia. *Vern.*—Bábchí.

(607) Gurgaon.
(1124) Delhi.
(1508) Amritsar.
(1987) Lahore.
Pattiala.

Seeds said to act as tonics and alteratives in skin diseases. Considered by natives to be hot and dry; useful in leprosy, and affections of the bile and skin diseases.

1194. Indigofera tinctoria. Indigo. *Vern.*—Nil; wasma; basma.

(1065) Delhi.
(2003) Lahore.

SEEDS—Nil ká bij; tukhm-i-wasma.*

(2004) Lahore.

LEAVES.—Barg-i-wasma.

(4) Gújrat.
(1527) Amritsar.

The seeds are small cylindrical, reddish, and with flat ends. The leaves, "wasma," are made into a dry greenish powder. The powdered seeds are used as a local application for ophthalmia, boils and dropsy. The leaves are used as dye, especially for hair. Indigo is said to be very poisonous. It is made in the Punjab in irregularly rounded lumps of a deep blue color, with a coppery lustre when rubbed. It is applied to severe ulcers, especially in horses. The flowers and leaves are also used in diseases of the liver and bowels. By Europeans the dye is occasionally used internally in epilepsy, and it colors the urine green.*

1195. Indigofera sp——. *Vern.*—Dant dawání.

(2111) Lahore.

Useful in fever. The plant is brought from the hills. It is probably *I. arborea*, or *I. heteranthera.*

1196. Clitoria ternata. *Vern.*—Shobánjan (H.); aprájit; shámí ka bij; vishnú kanti; níla ghiria; nílkanth; band pat; kálizar, kawá túntí; níl isband.

(2067) Lahore.
(2123) Lahore (seeds).
(2078) Lahore (flowers).
(2034) Delhi (seeds).

Said to be cooling and to act as an antidote to poisons. The roots are used as emetics and in rheumatism; the seeds in large doses are purgative and anthelmintic, and used for weakness of sight, sore

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* Indigo also is used in epilepsy by wrapping the patient in a sheet dipped in recent solution of indigo, so as to promote sweating; it is also employed as an astringent in diarrhœa.

throat, and mucous disorders. Also in tumours and the affections of the skin, and in dropsy.

Dose.—6 máshas. Price, 6 annas a seer.

1197. Glycyrhiza glabra. Liquorice. *Vern.*—Mulathi ; asl-us-sús.

(689) Gurgaon.
(1039) Delhi.
(1287) Jálandhar.
(1581) Gurdaspúr.
(1473) Amritsar.
(1814) Lahore.
(2382) Kashmír.
(2490) Nabha.
(1815) Lahore (extract, rab-us-sús).

The root is long cylindrical, brown without, yellow and soft within, but fibrous, sweet to the taste. The root is used for coughs or stammering in native medicine ; by Europeans it is extensively used as a demulcent and vehicle for other remedies.

Dose.—6 máshas. Price, 4 annas a seer.

The extract is made by evaporating a strong decoction of the root.

Dose.—1 másha. Price, 2 rupees a seer.

A fictitious extract is often made with gum, sugar, and various roots, boiled down together.

It acts as a demulcent, containing much peculiar sugar, and is used in catarrh and coughs: also in many diseases of the urinary organs, also to flavor other remedies.

1198. Tephrosia purpurea. *Vern.*—Sarphoka ; jojar ? sarpatka ? sarpanka.

(658) Gurgaon.
(1407) Amritsar.
(1717) Lahore.
(2302) Kashmír.
(982) Dehli (root, po-kil).

Used for dyspepia, dysentery, and to purify the blood. Also employed as a tonic and febrifuge. It is considered by natives astringent and bitter, useful in fever diseases of liver and spleen, also in eruptions and boils, and in difficulty of breathing and cough.

Dose.—6 máshas. Price, 2 annas a seer.

1199. Tephrosia sp—? *Vern.*—Mahín.
(2014) Lahore.

1200. Astragalus spinosus. *Vern.*—Atnil.
(2388) Kashmír.

A hard tabulated root-stock, with numerous long thin spinous branches.

1201. Astragalus hamatus. *Vern.*—Táj bádsháhi, aklel-ul-malik.

(1060) Dehli.
(1441) Amritsar.
(1887) Lahore.

Small yellowish curved legumes, with a deep furrow along the convex border. Named from its great efficacy in coughs and rheumatism, when given as an infusion.

Dose.—6 máshas. Price, 8 annas a seer.

1202. Alhagi maurorum. *Vern.*—Gokan; khár shutar ; jawása.

(1221) Jálandhar (the plant, gokan).

Manna.—Turanjabín turangbín.

(1061) Dehli.
(1984) Lahore.

The manna is said to exude from this plant in Persia. It is used by natives as a mild purgative in fever, dissolved in rose water.

The herb is said to be cool and bitter, to cure disorders of the bile and vertigo, also to expel wind and strengthen the system. The manna is used in coughs, vomiting, cholic, itching, uterine diseases, &c., and all pulmonary affections.

Dose.— 7 tolahs. Price, 1½ rupees a seer.

1203. Ervum lens. Lentil. *Vern.*—Masúr.
Jálandhar, &c., &c.
Pattiala.

Seeds small, circular and convex. Said to be difficult of digestion, but used as food : it is said to produce thirst, heat of skin and eruptions if freely used ; but it is said to be used in the treatment of ulcers, small pox, by applying a poultice of it.

1204. Abrus precatorius. *Vern.*—Rati ; ghúnchí.

Seeds.—Chunní safaid ; chirmiti ; hab-ul-súrk.

(1324) Jálandhar.
(1353) Hushyarpúr.
(1802) Lahore (white).
(1803) Lahore (red).
(655) Gurgaon.
(995) Dehli.
(2288) Kashmír.
(1804) Lahore (root).

White or red, hard, roundish, shining seeds, with a black hilum, having a white spot on shell. Root resembles closely that of liquorice: considered hot and dry. Principally used by natives as an ornament ; but is also administered in cholic and special diseases. The white seeds are considered to act as a poison producing vomiting and pains, purging, and convulsion : but are not usually fatal to man. The smallest fatal dose is 1 tolah. Price of the white 12 annas a seer ; of the red 4 annas. All parts of the plant are demulcent. The seeds are used in Egypt as food, but are indigestible. The root is commonly substituted for liquorice, and is very serviceable in coughs of children. The expressed juice of the fresh leaves is said to be useful in aphtha.

Of this creeper there are several varieties, with seeds scarlet, black and white. Those of a bright scarlet color, with a jet black spot at the top, are used by the jewellers and druggists as weights, each weighing almost uniformly one grain ;* also for beads and rosaries, whence the specific name. From their extreme hardness and pretty appearance, the Hindús prize them for necklaces and other ornaments. They are said to be innocuous if swallowed whole, but dangerous in a powdered state. On the latter point, however, there must be some mistake, as they form an article of food in Egypt, though considered hard and indigestible. They are occasionally employed in external applications in opthalmia. They are reduced to a fine powder by the goldsmiths, who use them in this state to increase adhesion in the more delicate parts of manufactured ornaments.

In Hindústán, they are known as the Rati weights. The root is employed as a substitute for liquorice. The leaves have a similar taste, and mixed with honey are applied externally in swellings of the the body, and pulverised and chewed with sugar, are given to mitigate coughs. RHEEDE states that the seeds mixed with the roots and cocoanut milk are given in hœmorrhoids. In Java, the roots are considered demulcent, and the mucilage is there combined with some bitter.

1205. Dolichos sinensis. *Vern.*—Lobiyáñ.
(1812) Lahore.

Considered hot and dry, diuretic, and difficult of digestion. Used in special diseases, and to strengthen the stomach.

Dose.—6 máshas. Price, 1 anna a seer.

1206. Dolichos sp———. *Vern*—Gulatthi.
(2009) Lahore.

1207. Mucuna prurita. *Vern.*—Kúnch ; kanaucha ; konch kari ; gúnch gají ; kawanch.

SEEDS.

(654) Gurgaon.
(1041) Delhi.
(1153) Ambálah.
(1348) Hushyarpúr.
(1570) Gurdaspúr.
(1810) Lahore.
(2335) Kashmír.

Seeds oval, brownish mottled, reniform, with a white linear hilum ; in one case they were labelled castor oil seed. The seeds principally used in special diseases, given with milk. The hairs of the pods are not used as anthelmintics in India, as they are in England, for round worm. They have been applied externally for paralysis, and produce much itching. The seed is said to absorb the poison of scorpions and to remain on a bite till all is removed. The leaves are said to be vermifuge.

Dose.—6 máshas. Price, 5 annas a seer.

1208. Alyssicarpus nummularia. *Vern.*—Nágbala.
(2102) Lahore.

1209. Butea frondosa.

SEEDS.—Palás pápri ; dák pápri ; dák-ka-bij.

(672) Gurgaon.
(1033) Delhi.
(1435) Amritsar.
(1787) Lahore.
(946) Dera Gházi Khán.

FLOWERS.—Kesú.

(1400) Amritsar.
(1600) Gurdaspúr.
(1741-1766) Lahore.
(2328) Kashmír.
(2527) Kangra.

DRIED JUICE.—Indian kino. Palás gond ; kamarkas ; dhák ki gond.

(1007) Delhi.
(1182) Dera Gházi Khán.
(1246) Jalándhar.
(2331) Kashmír.
Kangra.

Flowers papilionaceous, yellowish red, covered with down, flattened, and containing the petals and stamens.

Seeds large, flat, oval, compressed, smooth ; brown externally, yellow within.

Juice forms a ruby-colored translucent brittle gum, in small angular pieces with an astringent taste. When old the gum becomes of a darker color.

Flowers are principally used as a yellow dye for cloth ; also as a fomentation in dysuria. They are not generally used internally.

Price, 1 anna a seer.

The seeds are considered warm purgatives, and are used in fevers, and for new born infants ; and also as anthelmintics.

Dose.—6 máshas. Price, 4 annas a seer.

The juice is a powerful astringent, used for tanning and as a hair dye ; also in diarrhœa, pyrosis, and after parturition.

It is used as an astringent in diarrhœa and dyspepsia ; also in phthisis, and hœmorrhagic affections ; it is likewise employed as an application to ulcers and relaxed sore throats. It forms a good substitute for kino. It is said that the bark of the white-flowered dák tree, gives to persons who eat it supernatural knowledge.

Dose.—6 máshas. Price, 4 annas a seer.

*BIRDWOOD gives $\frac{15}{10}$ grains, apothecary's weight.

1210. Pterocarpus santalinus. Red sandal wood. *Vern.*—Rakta chandan (H.); chandan lál.

(1008) Delhi.

A red resinous wood, principally used for its red coloring matter, called Santalin, and as a dye Sometimes applied to the skin after bathing. Considered by natives a hot remedy; useful in bilious affections and skin diseases; also in fever, boils, and to strengthen the sight. It also acts as a diaphoretic, like gentian. It is applied to the forehead in headache; and also as a cosmetic.

1211. Pterocarpus draco, or calamus draco.—Dragon's blood. *Vern.*—Dam-úl-akhwain; khún siáwashán; hira da-khún; barg-i-bart?

(1017) Delhi.

(1979) Lahore.

A red hard resin, in large, somewhat cylindrical, lumps. It contains benzoic acid and tannic. A dry and cold remedy; used in dysentery and special diseases. A stimulant gum resin, chiefly used for its coloring matter: but is also very astringent.

Dose.—2 máshas. Price, 5 rupees a seer.

1212. Lupinus albus. *Vern.*—Zurufish; túrmuz.

(1052) Delhi.

Said to be brought from Egypt, and used as a carminative. Said to be useful in leprosy and internal heat.

Dose.—1 másha. Price, 5 rupees a seer.

1213. Phaseolus aconitifolius. *Vern.*—Moth.

(994) Delhi.

Used as a diet in fever. Considered by natives cool and dry, removes laxity of bowels and flatulency: it is said to produce worms. Its roots are considered narcotic.

1214. Phaseolus mungo. *Vern.*—Múng.

(1070) Delhi.

Used as a diet in fever. Considered by natives cool, light and astringent, but difficult of digestion; used to strengthen the eyes.

1215. Phaseolus Roxburghii. *Vern.*—Mash; úrad.

Peshawur.

Also used in fever, said to be the most esteemed kind of pulse. It is considered hot and tonic; useful in piles, paralysis, and affections of the liver; also in cough and rheumatism. Considered the most indigestible of the pulses.

1216. Cicer arietinum. *Vern.*—Chola; channa.

(1068) Delhi.

(1798) Lahore (variety).

(1078) Delhi (Kábulí chola).

(1063) Delhi (besan, gram flour).

Supposed to be cool and dry; also to increase the secretion of the bile: used as a stimulant article of diet in special diseases; also when roasted like coffee, considered aphrodisiac; also used in cases of flatulency, and in retention of urine and catamenia. It serves as a substitute for coffee. The fresh plant has an acid reaction, and if clothes are placed in a field of it in the dewy morning, and then wrung out they give an acid infusion.

1217. Sesbania Ægyptiaca. *Vern.*—Jaint; jaintar; jyantika (S.)

(1801-2139) Lahore.

(2126) Lahore (leaves, raisan or rásuan).

The seeds are applied externally mixed with flour for itching of the skin; they are also said to be stimulant emmenagogues.

1218. Sesbania aculeata. *Vern.*—Brihat-chakramed (H.)

(2165) Lahore.

1219. Dalbergia sissoo. *Vern.*—Shísham or sisú.

(1798) Lahore.

A very common tree. It is considered by natives to be hot. Useful in leprosy, boils, eruptions, and to allay vomiting; also in special diseases.

1220. Ceratonia siliqua. St. John's bread, or locust bean. *Vern.*—Kharnúb.

(1786) Lahore.

A thick pulpy flat brown curved pod, contains hard red seeds resembling those of the tamarind, imbedded in red fibrous pulp. Said to come from Kábul. Is used by the natives in coughs attended with much expectoration. The pods are used for food, both for men and horses, along the coasts of the Mediterranean; and are said to improve the voice of singers.

Dose.—1 másha. Price, 10 rupees a seer.

1221. Pisum sativum. Pea. *Vern.*—Matar.

A well known nearly spherical seed, with flattened sides. Introduced by the English. Used as stimulant food in special diseases. Considered by natives hot, aperient, and diuretic; useful in swellings, and to increase the secretion of milk. It is said that persons who sleep in fields of this plant become paralysed.

Dose.—6 máshas. Price, 2 annas a seer.

1222. Cajanus flavus. *Vern.*—Arhar.

(1022) Delhi.

Said to be hot and dry. A food which is said to produce costiveness, and to be useful in cold diseases. The leaves are used in diseases of the mouth. It is considered digestible and good for invalids.

1223. Crotalaria juncea. *Vern.*—San.

(1066) Delhi.

(1806) Lahore.

(2142) Lahore (leaves, &c., san pushp, H.)

Seeds flat, irregular, in shape oval or triangular, deep concave, surface smooth, or with one or two ridges; color, pale yellow to deep brown. The seeds are used to purify the blood in special diseases; but the fibre is not used for surgical purposes.

Dose.—6 máshas. Price, 4 annas a seer.

1224. Crotalaria medicinale? *Vern.*—Guláhi.

(2031) Lahore (from perguna Sarakpúr).

1225. Melilotus sp——. *Vern.*—Maltí.

(2137) Lahore.

1226. Entada pursetha. *Vern.*—Kastori kaman.

(1963) Lahore.

Said to be used in pains of the loins and debility. A large circular disk-shaped seed; said to be used as a weight in Southern India.

Dose.—6 máshas. Price, 1 rupee a seer.

1227. Pongamia glabrá. *Vern.*—Sukh-chain; karanj bará.

(2109-2132) Lahore.

The seeds yield an oil called karanj oil, which solidifies at 55°.

1228. Desmodium sp——.

SEEDS.—Detardána.

(2042) Lahore.

LEAVES.—Shiblingí, girikarní.

(2115-2160) Lahore.

CÆSALPINIÆ.

1229. Cassia elongata. Senna leaves. *Vern.*—Sanna makhi.

(998) Delhi.
(1518) Amritsar.
(1805) Lahore.
(2242) Dera Gházi Khán.
(2251) Do. (called ghiriwal).
(2220) Jhilam.
Shahpúr.
Pattiala.

Leaflets narrow, acuminate, unequal based veins, forming an intramarginal line. It contains a yellowish red solid, called cathartine, and some volatile oil. Used by natives as a purgative in many diseases. Used by Europeans as a purgative in habitual constipation, dyspepsia, derangements of the liver, and fever. It is stated in a native book that if it be used as the only food for one month, it prolongs youth and causes the hair to remain black, and gives universal strength: if eaten for 40 days, it produces a sweet smell.

Dose.—6 máshas. Price, 1 rupee a seer.

1230. Cassia tora. *Vern.*—Pawár; pañwár; chakunda; pawás.

(1789) Lahore.
(1387) Amritsar.
(2270) Dera Ghâzi Khán.
(678) Gurgaon.
(2427) Kashmír.
(1027) Delhi (leaves, chakúnda).

A warm remedy used in gout, sciatica, and pains in the joints. Seeds used to purify the blood and in skin disease; also as a blue dye. Leaves are used as a gentle aperient in fevers, and for children while teething, also as an application for ulcers, and ring-worm. AINSLIE.

The leaves are said to be used to adulterate senna (*Cassia obovata*), but are distinguished by their wedge-shape and ciliated margin.

Dose.—1 tolah. Price, 2 annas a seer.

1231. Cassia auriculata. *Vern.*—Tanghedar?* (S.) tarwar (H.); tálopota (S.)

(1025) Delhi.

Used as a refrigerent, and to purify the blood; also as an application in opthalmia, in which it acts as a local stimulant. The bark is said to be an astringent.

1232. Cassia alsus. *Vern.*—Cháksú; chásnak.

(599) Gugaira.
(1050) Delhi.
(1164) Ambálah.
(1282) Jalandhar.
(1316) Hushyarpúr.
(1582) Gurdaspúr.
(1799) Lahore.
(2464) Kashmir.

Seeds small, flat, oblong, with a projection at one end, black externally. They are used in the opthalmia of children, as an application to the eyes; an extract is also prepared by making a decoction, and then straining it, and this is called "sat chaksú," and is used to purify the blood. The seeds are also used in mucous disorders. It is supposed to act as a local stimulant in affections of the eye.

1233. Cassia sophora. *Vern.*—Brihatchitra (H.)

(2164) Lahore.

The juice of the leaves and the fresh root is considered useful in ring-worm. It is also said to be cathartic.

1234. Cathartocarpus fistula. Purging cassia pods. *Vern.*—Ambaltás; khiyár shambar.

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* This is given in the Delhi list, but in books it appears as the Telugu name; I never heard the word in the Punjab.

(691) Gurgaon.
(990) Delhi.
(1160) Ambálah.
(1194) Simla.
(224) Jálandhar.
(1349-1350) Hushyarpúr.
(1386) Amritsar.
(1565) Gurdaspúr.
(1783) Lahore.
(2185) Rawalpindi.
(2245) Dera Gházi Khan.

BARK. *Vern.*—Saki; girdnallí (Dera Gházi Khán).
(1995) Lahore.
(2472) Kashmír.
(2245) Dera Gházi Khán.
(686) Gurgaon.

Legume cylindrical, 12 to 16 inches long, smooth, dark or black externally, containing numerous transverse woody dissepiments, covered with a dark thick sweet pulp in which lie the seeds. The pulp is used as a purgative, both by natives and Europeans. One seer of the fruit gives half a seer of pulp. The bark is astringent, and used to purify the blood. The flowers are said to be laxative, and to be used for flavoring meat.

Dose.—9 tolahs, 1½ to 2 ounces.

1235. Cæsalpinia sappan. Sappan wood. *Vern.*—Bakam; pathangá (S. and H.); vakm; kanjúr?
(975) Delhi.
(1784) Lahore.

Used by natives to purify the blood, and as a powerful emmenagogue; also as a red dye. Europeans consider that its action is similar to logwood. Used as an astringent in diarrhœa, dysentery, &c.

Dose.—6 máshas. Price, 4 annas a seer.

1236. Guilandina bonduc. *Vern.*—Katkaranjwa; karanjí; kanjúá; mithla?; bankat, or katkalcji.
(991) Delhi.
(1182) Ludhiana.
(1458) Amritsar.
(1560) Gurdaspúr.
(2007) Lahore.
(2222) Shahpúr.
(2275) Kashmír (kanjúá).
Pattiala.

A hard round seed, about the size of a gall, brown externally, white within, very bitter. Considered by natives hot and useful in piles, worms, and leprosy; and used to purify the blood, and as a tonic in fever and spleen disease; also as an astringent in special diseases.

Dose.—6 máshas. Price, 3 annas a seer.

Externally it is said to be useful in hydrocele. It is a valuable bitter tonic and febrifuge: often given in conjunction with assafœtida and black pepper, in intermittent fevers and dyspepsia. It contains a peculiar resin, also sugar, starch, gum, and oil. The root bark is said to be more efficacious in fever than chinchona itself.

Dose.—Grains 10 to 20.

1237. Tamarindus indica.

FRUIT.—Imlí.
(1087) Delhi.
(1278) Jálandhar.
(1784-2101) Lahore.
(2380) Kashmír.
Pattiala.

SEEDS.—Imlí ká bíj.
(1785) Lahore.

LEAVES.—Chíncha.
(2101) Lahore.
(2044) Lahore (confection, chitramúl).

Legume flattened, often curved irregularly compressed; filled with dark acid pulp, and a few smooth hard flattened thick seeds, with a dark red exterior. The pulp is used as a purgative in many diseases, especially jaundice, fever, and melancholy: also with water as a refrigerent drink. The seeds are used as anthelmintics and in special diseases, and the kernels deprived of their skin, as food, after roasting and soaking in water. The leaves and the bark are stated to be astringent and useful in diarrhœa. By Europeans it is considered a gentle laxative and aperient, principally used as an adjunct to senna.

Dose.—2 tolahs. Price, 4 annas a seer.

1238. Bauhinia variegata, var. purpurea. *Vern*—Kachnál.
(1425) Amritsar.
(1809-1818) Lahore.

The buds are tawny colored bodies, composed of several layers of floral envelopes and stamens. The bark is used as a tonic in fever. The dried buds are used as food, and also as a remedy for piles and dysentery. They are considered by natives cool and astringent, and are useful in diarrhœa and worms.

Dose.—1 chitak. Price, 1 anna a seer.

1239. Bauhinia acuminata? *Vern.*—Shwet kachnár; kachnál safaid.
(2052) Lahore.

1240. Bauhinia racemosa. *Vern.*—Murta or múrt (H.); mahlú.
(2140) Lahore.

The leaves of several species are used Bengal as demulcents and mucilaginous remedies in dysentery. The seeds are eaten, and are said to be tonic and aphrodisiac.

1241. Acacia Arabica. *Vern.*—Kikar or babúl.

JUICE.—Akákiá.

(999) Delhi.
(1794) Lahore.

LEAVES.—Kikar ke patte.

(1795) Lahore.

FLOWERS.—Kíkar ke phúl.

(1225) Jálandhar.

PODS.—Kikar ká bij, phal bábul.

(1225) Simla.
(1433) Amritsar.
(1792) Lahore.
(2259) Dera Gházi Khan.

BARK.—Post-kíkar.

(1793) Lahore.
(2A) Pattiala.

GUM.—Kikar gond ; gond-i-bábul ; chír.

(1026) Delhi.
(1256) Jálandhar.
(1395) Amritsar.
(1796) Lahore.
(2279) Pattiala.
(2317) Kashmír.

The juice forms dark flat cakes with a sweet and astringent taste. The bark is long, thick, and fibrous brown externally, reddish within. The flowers are in small round yellow heads, composed of numerous tubular florets. The pods are flattened, contracted between the seeds on both sutures, and expanded opposite to them. The juice is prepared by evaporating a decoction of the bark mixed with milk. It is used for coughs. It acts as a demulcent and astringent.

Dose.—1 másha.

The leaves are used in mucous discharges. The pods are used in coughs, and in distilling spirit.

Dose.—1 másha. Price, 1 anna a seer.

The bark is used by natives in snake bites, and as an application to cancer and ulcers. The bark is used as an astringent in diarrhœa, and for tanning. It is also used in fermenting sugar for distilling.

Dose.—3 máshas. Price, 1 anna a seer.

The gum exudes principally in March and April ; there are two kinds—the red and white—the former is the most efficacious. It is used in coughs, rheumatism, mucous discharges, and special diseases.

It acts as a demulcent, and is said to be useful as food in diabetes. It has been employed as a local application in bleeding and to burns.

Dose.—4 máshas, or 30 to 60 grains. Price, from 4 to 6 annas a seer.

1242. Acacia farnesiana (Gum of). *Vern.*—Gond babúl.

(1056) Delhi.

Used as a sort of gum Arabic. The gum is in dark conchoidal masses, translucent or transparent at the edges. Some pieces are much whiter. The pods are said to contain a balsamic liquid.

1243. Acacia modesta. *Vern.*—Phulahi ; gum (Bhimbri gond).

(1790) Lahore (leaves).
(2333) Kashmír (gum).

Sometimes used instead of gum Arabic.

1244. Acacia speciosa. *Vern.*—Siris; sirin.

(1434) Amritsar.
(1818) Lahore.

Seeds are used by natives in treatment of piles, and as an astringent in diarrhœa. The flowers are considered by natives cool : to cure boils, eruptions, and swelling, and act as antidotes for poisons ; also in headache and jaundice. The leaves are useful in opthalmia. The powdered bark is useful for ulcers, and especially in snake wounds. The oil extracted from the seed is said to cure white leprosy. The seeds are said to be useful in urinary diseases, especially gonorrhœa.

Dose.—6 máshas. Price, 1 anna a seer.

1245. Acacia catechu. *Vern.*—Kath.

(761-1381) Amritsar.
(1010) Delhi.
(1317) Jálandhar.
(2021) Lahore.

In irregular square cakes of a light reddish color within and brownish externally : very astringent. It contains mimotannic acid, a variety of tannin, and red catechuic acid. Made by boiling the cut wood of the *Acacia catechu*, "khair" for some time with water, then straining and evaporating the decoction to a fitting consistency. The catechu sold in the Punjab is always the pale variety, in square cakes ; this is stated in the British Pharmacopœia to be the produce of the *Uncaria gambir*, which plant does not grow in this part of India, while the *Acacia catechu* is very common. It is a very useful astringent and styptic, much employed in diarrhœa, dysentery, and mucous discharges. It is said to be useful in phthisis, also in opthalmia. It is also used as an application to inflamed gums and ulcers, and to relaxed sore throats ; and by natives in fever, leprosy, and eruptions.

Dose.—1½ másha. Price, 8 annas a seer.

1246. Mimosa pudica. *Vern.*—Lájwanti.

(1820) Lahore.

A cold remedy, used to purify the blood, and in gravel. The leaves are useful in piles and fistula.

Dose.—6 máshas.

1247. Mimosa rubicunda. *Vern.*—Dev khádir.

(2100) Lahore.

1248. Prosopis spicigera. *Vern.*—Sankri (the pod.)

Pod long, irregularly cylindrical, sweet to the taste, often esculent; the tree is excellent for fuel, and is called "jhand."

ROSACEÆ.

1249. Amygdalus communis, A. dulcis. *Vern.*—Badám shírín.

(1057) Delhi.

(1554) Amritsar.

(1823) Lahore.

1250. Amygdalus amara. *Vern.*—Talkh badám; hab-ul-lauz talkh; karwa bádám.

(988) Delhi.

(1822) Lahore.

Almond seeds are brown, lanceolate, ovate, with a white sweet kernel. They contain 54 per cent. of fixed oil; also emulsine, a kind of albumen, 29 per cent; sugar 9 per cent. The sweet almonds are considered dry and warm remedies, and are used in headache and debility; also in coughs. Oil is made from them.

Dose.—6 máshas. Price, 4 annas a seer.

The bitter almonds are used in deafness and as a deobstruent; also against the effects of intoxication, in ague, calculus, and toothache. A branch of the tree is said to keep flies from the room in which it is placed.

Price, 1 rupee a seer.

Bitter almonds have often proved poisonous, as they contain a peculiar substance, called Amygdaline, which, under the influence of a solution of the albumen of the almond, produces prussic acid. They are said to be useful as a local application in skin disease, especially in prickly heat; also in heart-burn: and the sweet variety are used as food in diabetes. The bitter kind has also been employed in fever, as an anthelmintic in tape worm, and to prevent intoxication. Very often the kernels of the plum, *Prunus Domesticus (alucha)* are substituted for the bitter almonds.

1251. Prunus armeniaca. Apricot. *Vern.*—Zard alú; khubání; alú Kashmírí; kishta.

FRUITS.

(1123) Delhi.

(1825-2016) Lahore.

(2291-2332-2453) Kashmír.

(2186) Rawalpindi.

STONES.—Tukhm-i-zard alú; bádám talkh pahárí; sárí.

(1823) Lahore.

(2236) Kashmir

Grows in the hills. The fruit is considered a warm remedy, and is used for coughs, and as an article of food. Likewise by hakíms in skin diseases, flatulency and putrid fevers, to quench thirst, to arrest diarrhœa, to purify the stomach, and expel unhealthy bile.

Dose.—3 máshas. Price, 5 annas a seer.

1252. Prunus domestica. Plum. *Vern.*—Alúcha.

(2370) Kashmír.

The dried drupes. Used as a laxative in coughs and asthma, and an addition to other purgatives: they are acid and refrigerent.

1253. Prunus domestica, var. Bokhariensis. *Vern.*—Alu bukhára.

(1105) Delhi.

(1304) Jálandhar.

(1821) Lahore.

A cold remedy. The fruit is used as a refrigerent laxative in fever and indigestion, both as a cold infusion, and as an electuary. It is principally brought from Peshawur. By Europeans it is principally used as a laxative in combination with senna.

Dose.—9 fruits. Price, 4 annas a seer.

1254. Prunus padus (Cerasus). *Vern.*—Jáman.

(2557) Kashmír.

The kernel yields a poisonous volatile oil, similar to oil of almonds.

1255. Prinsepia utilis. *Vern.*—Bekrúl. Simla.

Yields a useful oil.

1256. Cerasus communis. *Vern.*—Gilás; girása.

(1826) Lahore (from Kábul).

An edible fruit, used as a cold remedy in insanity. The kernel is said to relieve the pains caused by calculus in the bladder, and to dissolve the stone.

ROSEÆ.

1257. Rosa centifolia. *Vern.*—Guláb gul-i-surkh.

PETALS.

(1161) Ambálah.

(1143-1186) Ludhiana.

(1230) Jálandhar.

(1452-1549) Amritsar.

(1828-1832) Lahore.

(2172) Rawalpindi.

(2219) Jhilam.

(2364) Kashmír.

(2491) Nabha.

Pattiala.

STAMENS.—Guláb zíra.

(1833) Lahore.

STEM.—Kubjak (Hindí medicine).

(2133) Lahore.

The petals are red, broadly ovate, and wrinkled, with a sweet smell, owing to the presence of volatile oil; they also contain some tannic acid. The petals are used as laxatives for children. The stamens are considered to arrest purging. In European medicine, they are considered to be slightly astringent, but are principally used to mix with other remedies.

CONSERVE OF ROSES.—Gul khand.

(1822) Lahore.

It is said to contain citric and malic acid; also sugar, and a little volatile oil. This is prepared by carefully separating the red petals of the rose from all other parts: these are then beaten with sugar into a pulp and dried in the sun. Used as a purgative in cholic.

Dose.—2 tolahs. Price, 8 annas a seer.

1258. Rosa glandulifera. *Vern.*—Gul seotí (or sewati).

(1516) Amritsar.

(1830) Lahore.

A cold remedy: used for palpitation of the heart.

Dose.—6 máshas. Price, 1 rupee a seer.

1259. Rosa sinensis. *Vern.*—Sádá guláb.

(1832) Lahore.

1260. Rosa sp.—incerta. *Vern.*—Nasrín; kubjak.

(2357) Kashmír.

(2135) Lahore.

(2421) Kashmír (barg-i-nasrín, leaves).

POMACEÆ.

1261. Pyrus communis. *Vern.*—Kishta bahíra? naspáti.

(1375) Kashmír.

Fruit nutritive, contains much sugar.

1262. Cydonia vulgaris. Quince. *Vern.*—Bedána or bihdána; bihi tursh; safarjal (Arabic).

(1045) Delhi.

(1497) Amritsar.

(1824) Lahore.

(2393-2424) Kashmír.

Pattiala.

Grows at Lahore; but the best kinds are obtained from Peshawur and Kashmir. The seeds act as demulcents; and by natives are used in diarrhœa, dysentery, sore throat, and fever. The seeds are ovate, pointed, convex on one side, and flattened on the other. They abound in very soluble mucilage, and are used in aphthous affections, diseases of the mouth, and ophthalmia; also to cracks on the skin, and in dysentery. The dried fruit is used as a refrigerent, and recommended in special affections.

Dose.—6 máshas. Price, 1½ rupees a seer.

CUCURBITACEÆ.

1263. Cucurbita pepo. *Vern.*—Kadú (seeds); magz kadú; kúnda?

(662) Gurgaon.

(1101) Delhi.

(1261) Jálandhar.

(1546) Amritsar.

(1691) Lahore.

(2454) Kashmír.

Seeds are cooling. Leaves used for an application to burns. The fruit is cool, useful to create an appetite and assist digestion; also employed in gravel and disorders of the urinary bladder. A sherbet is made from it by filling the hollow centre with sugar, and exposing it to the sun till it turns acid.

1264. Cucurbita lagenaria. *Vern.*—Tomrí.

(1688) Lahore.

Seeds cooling: leaves purgative. The bitter pulp is stated by DR. ROYLE to be poisonous. It is considered by natives to be cool: useful in coughs, and as an antidote to poisons.

1265. Cucurbita citrullus. Water-melon. *Vern.*—Tarbúz.

(683) Gurgaon.

(1247) Jálandhar.

(1685) Lahore.

(2447) Kashmír.

Pattiala.

(2259) Dera Ghází Khán.

Fruit refrigerent, very watery and edible; used in fever: contains much water and sugar.

1266. Cucumis melo. Musk-melon. *Vern*—Kharbúza.

(1163) Ambálah.

(681) Gurgaon.

(1187) Ludhiana.

(1239) Jálandhar.

(1428) Amritsar.

(1689) Lahore.

(2272) Dera Ghází Khán.

(2447) Kashmír.

(1037A) Delhi (rind of fruit, kharbúza ka chil).

Fruit refrigerent, difficult of digestion: seeds used for cases of calculus, and as diuretics. Considered by natives hot and dry.

1267. Cucumis sativus. Cucumber. *Vern.*—Khíra; khiyár (Pers.)

(680) Gurgaon.

(1187) Ludhiana.

(1223) Jálandhar.

(1430) Amritsar.
(1602) Gurdaspúr.
(1690) Lahore.
Pattiala.
(2448) Kashmír.
(1049) Delhi.

Fruit refrigerent. Considered by natives cool and dry. It is diuretic and aperient, and said to be useful in disorder of bile, calculus, and suppression of urine; also to be very useful for remittent fever. The seeds contain much oil. The juice is said to kill cockroaches and woodlice, and the peel is equally efficacious.

1268. Cucumis pubescens. *Vern.*—Kakri.

(680) Gurgaon.
(1421) Amritsar.
(1686) Lahore.

Considered cool and astringent: it creates appetite and removes bilious disorders.

1269. Citrullus colocynthus. *Vern.*—Indrain; hanzil; kortumbah; tummah.

(1097-1102) Delhi.
(1191) Ludhiana.
(1437) Amritsar.
(1687) Lahore.
(2171) Rawalpindi.
(2221) Jhilam.
(2258) Dera Ghází Khán.
Shahpúr.

ROOT.—Hanzil ka jar.

(966) Delhi.
(1191) Ludhiana (kortumbah ka jer).

The rind is hard, yellow, the fruit is about the size of an orange; the pulp is light yellow and spongy, containing the seeds. The true colocynth of European medicine is a powerful purgative, much used in constipation, dyspepsia, dropsy, and affections of the head, such as apoplexy.

It contains a peculiar neutral bitter principle, colocynthine, and acts as a powerful hydragogue, cathartic, and emmenagogue. It is said also to stop gonorrhœa. It is considered by natives hot and moist and to be a purgative and anthelmentic. Useful in jaundice, dropsy, and fever, and diseases of the liver and spleen.

Dose.—Grains 5 to 10.

1270. Bryonia? *Vern.*—Shibling (Hindi).

(2114) Lahore.

A purgative and anthelmentic; externally, it acts as a rubefacient; internally it purges and is said to stop the secretion of milk.

1271. Momordica charantia. *Vern.*—Karila.

(1122) Delhi.
(1254) Jálandhar.
(1422) Amritsar.
(1692) Lahore.

Very bitter: acts as an anthelmentic. Sometimes used in brewing. Considered by natives cool and laxative: useful in piles, jaundice, and as a vermifuge; also to strengthen the stomach and in special affections; also it is useful after parturition.

1272. Momordica muricata. *Vern.*—Kakora.

(1693) Lahore.

Similar to karila: useful in ague, and as an antidote for poisons.

1273. Momordica echinata. *Vern.*—Bindal; khagarwal.

(657) Gurgaon.
(245) Dera Ghází Khán.
(1869) Lahore (khagarwal).

It is hot and dry: used in piles and epilepsy.

1274. Luffa tenera. *Vern.*—Karwa turai.

(1028) Delhi.

Every part extremely bitter: fruit cathartic and emetic; juice applied to the temples for headache.

1275. Luffa acutangula. *Vern.*—Káli tori.

(1122) Jálandhar.

The seeds are said to produce purging and vomiting in doses of 15 grains.

ONAGRACEÆ.

1276. Trapa bispinosa. *Vern.*—Singhára.

(1018) Delhi.
(1000A) Amritsar.
(1913) Lahore.

The nuts are farinaceous, used as food, and in special diseases. It is considered by natives cool and sweet, that it cures bilous affections and diarrhoea: it is greatly used as a food in the rainy season. The nuts are used to form poultices.

LYTHRACEÆ.

1277. Grislea tomentosa. *Vern.*—Dhao; gul dháwi; gul bahar; dhawa ka phúl.

(1431) Amritsar.
(2028) Lahore.
(2318) Kashmír.

The dried flowers are stimulant, especially in pregnancy; also used in dyeing. Considered by natives cool; used in piles, bilious and mucous disorders.

1278. Lawsonia inermis. *Vern.*—Mendhí; hanná.

(989) Delhi.
(7031) Amritsar.
(1183) Ludhiana.

(1834) Lahore.
(2236) Dera Ghází Khán.
(2416) Kashmir.

Used to dye the hands of a red color by rubbing the powdered leaf between them; also as a medicine to purify the blood. It contains a peculiar sort of tannic acid: it is sometimes applied as an astringent to ulcers of the mouth; also in cases of lepra and skin disease. AINSLIE.

MYRTACEÆ.

1279. Myrtus communis. Myrtle. *Vern.*—Sutrsowa; ás (Arab.); wilaiti mendhi; barg morad.

BERRIES.—Hab-ul-ás.

(1117) Delhi.
(1524) Amritsar.
(1990) Lahore.
(2243) Dera Ghází Khán.

Leaves used in tanning and to distil an essental oil: they act as astringents and aromatics, and were formerly employed as spices. The bark and the leaves are said to be useful in tanning, and the berries in dyeing.

The leaves are used by hakims in cerebral affections, especially epilepsy; also in flatulency, diseases of stomach and liver. The fruit in diarrhœa, hæmorrhage, and ulceration of the womb.

1280. Caryophyllus aromaticus. Cloves. *Vern.*—Laung; karanfal.

(1293) Jálandhar.
(1059) Delhi.

A dark brown substance like a nail, consisting above of a ball of petals and stamens, below a four-pointed calyx, and below this a tapering stick-like ovary. It contains much volatile oil and tannic acid. Considered by natives a warm, dry remedy, given internally in fever and debilty, and applied externally in anæsthesia.

Dose.—1 to 3 máshas. Price, 8 annas a seer.

Hakíms consider it a tonic to the stomach and liver. Used in European practice as a stimulant carminative, especially in cholic. The oil is applied in toothache; also used in dyspepsia and as an adjunct to other remedies.

Dose.—5 to 20 grains.

1281. Punica granatum. Pomegranate.

BARK OF STEM.—Post anár.

(1224) Hushyarpúr.
(2387) Kashmir.

LEAVES.—Dárimpatra (Hindí).

(2156) Lahore.

BUDS.—Anár kalli.

(1022) Delhi.

FLOWERS.—Gul anár, darím pushp (Hindi).

(1750) Lahore.
(1453) Amritsar.

RIND OF FRUIT.—Naspál, chál anár.

(980) Delhi.
(1189) Ludhiana.
(1351) Hushyarpúr.
(1592) Gurdaspúr.
(1749) Lahore.
(2387) Kashmír.

SEEDS.—Anár dána, dárimesar? hab-ul khilkhil.

(677) Gurgaon.
(1046) Delhi.
(1224) Jálandhar.
(1384) Amritsar.
(1748) Lahore.
(2180) Rawalpindi.
(2372) Kashmír.

The fruit is globular, brown, and curved by the calyx, containing numerous yellowish seeds, embedded in red pulp. The rind is hard, brown externally, yellow and rough within, curved in every direction. The root bark is in thin quills, brown externally and yellowish within; both the bark and the rind contain tannic acid and punicine. The bark of the root, called "rumán," is a powerful anthelmentic and astringent, and is especially useful for tape-worm and for thread-worms. The rind of the fruit acts as a tonic astringent and anthelmentic; and is used for tanning. It is also powdered and boiled with milk as an astringent in diarrhœa. The buds act similarly to the fruit rind. The fruit is refrigerent and astringent, and is used in fevers, and debility of the stomach. The seeds are used as refrigerent and astringent remedies. The flowers are used as refrigerent, and astringent drugs also. All parts of the plant are rich in tannic acid, and act as astringents and anthelmentics. It is principally used in dysentery and chronic diarrhœa; also as a remedy for tape-worms; also as a local application for relaxed sore throat, and cancer of the uterus.

1282. Psidium pyriferum. Guava. *Vern.*—Amrúd; anjír zard.

(1827) Lahore.
(2375) Kashmír.

Fruit edible. Used in medicine as an astringent in diarrhœa, and is supposed to strengthen the stomach.

COMBRETACEÆ.

1283. Terminalia chebula. *Chebulic myrobalan. Vern.*—Har; harhar; balela zard.

(1158) Ambálah.
(1276) Jálandhar.
(1339) Hushyarpúr.
(1491) Amritsar.

(1588) Gurdaspúr.
(1973) Lahore.
(2365) Kashmír.
(2494) Nabha.
Pattiala.

Used as an astringent in ophthalmia, and to purify the blood; also a purgative in many diseases. The price and the supposed efficacy increases with the size of the fruit, one weighing 6 tolahs would cost Rs. 20. It is powerfully astringent, said to be more so than galls. It is used also for tanning, dyeing, and making ink. It acts internally as a useful aperient; externally as an astringent application to ulcers and skin diseases.

Dose.—6 máshas.

1284. Terminalia citrina? or T. chebula? *Vern.*—Harir; halelah syah; halela jangí; halelah khúrd; har jangí.

(934) Delhi.
(1339) Hushyarpúr.
(1589) Gurdaspúr.
(1491) Amritsar.
(1974) Lahore.
Pattiala.

Said to be the young state of the *Chebulic myrobylan*, usually employed as a purgative; the smallest is the most sought after.

1285. Terminalia arjuna. *Vern.*—Arjan.

(1336) Jálandhar.
(2158) Lahore.

Said to be hot and astringent: useful in bilious affections, and as an antidote to poisons. The fruit is used as a tonic and deobstruent. The bark is astringent and febrifuge. The juice of the leaves is useful in earache. AINSLIE.

Dose.—2 to 4 máshas. Price, 7 annas a seer.

1286. Terminalia bellerica. *Belleric myrobalan. Vern.*—Bahíra; Persian, balela.

(670) Gurgaon.
(1024) Dehli.
(1288) Jálandhar.
(1341) Hushyarpúr.
(1445) Amritsar.
(1911) Lahore.
(2394) Kashmír.
(2495) Nabha.
Pattiala.
Sirmúr.

Considered a hot dry and astringent remedy; useful in dropsy, piles, diarrhœa, and leprosy; also fever. Used for coughs and as a food. Is, in small doses, an astringent tonic; in larger ones, a narcotic poison: also used for dyeing and as a purgative.

TRIPLA TIRPHALA; OR TRIPHALA.

(2041) Lahore.

A mixture of the three common *Myrobalans*—the chebulic, *P. chebula*; the belleric, *T. bellerica*; and the emblic, *Phyllanthus emblica.*

1287. Combretum nanum. *Vern.*—Dant jathi (Hindi).

(2089) Lahore.

UMBELLIFEREÆ.

1288. Apium involucratum. *Vern.*—Ajmúd; karafs.

FRUITS.—Ajwain, ajmúd.

(1482) Amritsar.
(1920) Lahore.
(2399) Kashmir.

ROOT.—Bekh-karafs.

(997) Delhi.
(2409) Kashmír.

LEAVES.—Phút jata (Kashmir).

(2425) Kashmír.

Roots diuretic and laxative: used for jaundice and gravel. Supposed to be bitter and heating, and to remove cholic, increase the appetite, remove fœtid breath, flatulence, stoppage of urine or menses. Both the root and the fruits act as diuretics and stimulants, and are used in cases of calculus and gravel: also in rheumatism and coughs; also to relieve hiccough.

The wild plant is considered to be poisonous. It is an aromatic stimulant, useful in cholic, diarrhœa, and catarrh; also in fever. It probably contains Apiol, an oily liquid used as a substitute for quinine.

Dose.—3 máshas.

1289. Bupleurum marginatum. *Vern.*—Sarb (ghás).

(2294) Kashmír.

Used as a diuretic and laxative.

1290. Ptychotis ajwain. *Vern.*—Ajwain.

(632) Gurgaon.
(1180) Ludhiana.
(1116) Delhi.
(1159) Ambálah.
(1259) Jálandhar.
(1200) Simla.
(1590) Gurdaspúr.
(1338) Hushyarpúr.
(1389) Amritsar.
(1919) Lahore.
(2191) Gujrát.
(2213) Jhílam.
(2176) Rawalpindi.
(2244) Dera Ghází Khán.
(2356) Kashmír.
(2484) Jhínd.
(2486) Nábha.

Bitter, pungent and heating; it assists digestion, improves the appetite, is used in catarrh and rheumatism. Also used for cholic, both in men and horses; and for fever, rheumatism and dyspepsia, and in stoppage of urine. It is a useful stimulant carminative, which deserves to be more used in cholic. It yields a useful essential oil.

Dose.—3 máshas. Price, 3 annas a seer.

1291. Ptychotis sylvestris? *Vern.*—Wal ajwain.

(1964) Lahore.

Fruit carminative like ajwain.

1292. Carum gracile. *Vern.*—Kálázira; zira siyah.

(972) Delhi.
(1285) Jálandhar.
(1922) Lahore.
(1469) Amritsar.
(1000A) Delhi.
Kashmír.

Fruit black, slender and nearly linear, with five ridges and oil channels between them. They contain much volatile oil. A carminative and stimulant remedy. Used for indigestion, rheumatism and enlargement of the spleen; also in neuralgia; and as a vermifuge, and to obviate the bites of serpents. By Europeans they are principally used in cholic and dyspepsia; also in flatulency.

Frequent mistakes have arisen from a confusion of the vernacular names of plants called "zíra," a number were sown by Dr. Brown, who reported to the A. H. Society as follows:—

"Among the seeds which germinated, were several more or less confused in the catalogue, under the names of kálájira; kaleejeree; and kálazeera; these were all sown and produced plants. The first generally called kalajera, but also kalonja, was a small black triangular seed, which, when sowed, produce a plant evidently belonging to the natural order Ranunculaceæ, and resembling the *Nigella sativa* (Linn.)

"The second, kaleejeree, when sown produced a Composite flower, which answered to the description of the *Serratula anthelmintica.* And the last, kalazeera, produced an evidently umbelliferous plant, but this unfortunately did not flower owing to the heat of the season: this however was in all probability the *Carum nigrum*, to which the above name is generally given in books."

Dose.—7 máshas. Price, 12 annas a seer.

1293. Cuminum cyminum. Cummin. *Vern.*—Zíra safaid.

(972-1107) Delhi.
(1174) Ludhiana.
(1411) Amritsar.
(1921) Lahore.
(2487) Nabha.
(2264) Dera Ghází Khán.

Fruit concave, convex, rather larger than coriander, with nine ridges, and four vittœ or oil channels. A warm and dry remedy, used in indigestion, cholic, diarrhœa and special diseases; also in spleen disease and vomiting. Used by the hakíms in flatulency, suppression of milk, urine, and catamenia.

Dose.—6 máshas. Price, 4 annas a seer.

1294. Pimpinella involucrata. *Vern.*—Anísún.

(1442) Amritsar.
(1925) Lahore.
(2295-2380) Kashmír.

Considered by natives hot and dry, and used for cholic and indigestion. A stimulant carminative and deobstruent remedy; principally used for flatulency and dypepsia: said to be useful in phthisis. It is also said to be diuretic and emmenagogue; also to augment the secretion of milk, and to relieve headache.

Dose.—6 máshas. Price, from 8 annas to 2 rupees a seer.

1295. Daucus carota. Carrot. *Vern.*—Gájar; Pers., zardak.

(1169) Ludhiana.
(1240) Jálandhar.
(1924) Lahore.
(2435) Kashmír.

The root contains volatile oil, albumen, pectine, and a peculiar red principle, called carotine. Used as a diuretic in calculus and special diseases, also in abdominal pain in women and debility; it creates appetite and cures eruptions.

Fruit carminative and diuretic. Root used for food and as an application to ulcers. Seeds formerly used in dyspepsia and cholic. It is stated that if a horse is fed on carrots for a month, it will remain free from disease for a year.

Dose.—4 tolahs. Price, 1 pice a seer.

1296. Anethum sowa. Dill. *Vern.*—Soya; shibt (Arab).

Fruits.

(637) Gurgaon.
(985) Delhi.
(1156) Ambálah.
(1359) Hushyarpúr.
(1212) Jálandhar.
(1405) Amritsar.
(1923) Lahore.
(1181) Ludhiana.
(2207) Gujrát.
(2381) Kashmír.
(2493) Nabha.

(1963) Lahore (the plant).
(2299) Kashmír.

The fruits are oval and flattened, with five ridges and four oil channels, and a membraneous margin; they are slightly convex on one side. It is considered by natives as a warm remedy; used for cholic, especially in horses; also for indigestion and abdominal pains in women, and to increase the secretion of milk. Fruit aromatic and carminative; used for flatulence, cholic, and hiccough, especially of infants.

Dose.—6 máshas. Price, 2 annas a seer.

1297. Fœniculum vulgare. *Vern.*—Soňf; bádyán.

(634) Gurgaon.
(1011A-1115) Delhi.
(1215) Jálandhar.
(1358) Hushyarpúr.
(1382) Amritsar.
(1557) Gurdáspúr.
(1917) Lahore.
(1163) Ludhiana.
(1154) Ambálah.
(2174) Rawalpindi.
(2214) Jhilam.
(2204) Gújrat.
(2265) Dera Ghází Khán.
(2485-2388) Kashmír.
(2483) Pattiala.
(2481) Jhínd.

ROOTS.—Bekh badyán.

(1488) Amritsar.
(1918) Lahore.
(2422) Kashmír.

The fruits are oblong, convex on one side, flat on the other; or convex on both, from the union of two by their flat surfaces. The root is said to be purgative, and the leaves diuretic. AINSLIE.

They contain volatile oil. The fruit is a stimulant aromatic, carminative, much used in cholic, flatulency, dyspepsia, but is inferior to ajwain. It is said greatly to increase the flow of milk, especially when diminished by indigestion; also to increase the urine and menses, and to relieve flatulency.

1298. Coriandrum sativum. *Vern.*—Dhaniyán; kashniz (Pers.)

(649) Gurgaon.
(1027-1070) Delhi.
(1183) Ludhiana.
(1199) Simla.
(1243) Jálandhar.
(1397) Amritsar.
(1569) Gurdaspúr.
(2178) Lahore.
(2192) Rawalpindi.
(2215) Gújrat.
(2490) Jhilam.
(2329) Jhínd.
(2090) Kashmír.
Simla.
Pattiala.

The fruit is globular, marked with five ribs. Seeds used in headache, cough, debility; also as a food and a perfume. Considered cool and dry.

Dose.—6 máshas. Price, 1½ annas a seer.

The green plant is also eaten, called "khotmír." A useful aromatic, stimulant and carminative, used in cholic and diarrhœa; it contains much volatile oil.

Dose.—Grains 10 to 30.

1299. Prangos pabularia. Petrasoleum. *Vern.*—Fitrásályún.

(1928) Lahore, from Thibet.

Used for debility, indigestion, and rheumatism.

Dose.—3 máshas. Price, 2½ rupees a seer.

The leaves are used as fodder for sheep, they are rather heating, but are said to fatten cattle readily, and to prevent the liver fluke. This plant is believed to be the *Sylphum* mentioned by ARRIAN. The native name, "fitrásályún," is probably a corruption of "parsley." It is described by LINDLEY as being a perennial herbaceous plant, stem taper, leaves very compound with linear segments, umbels numerous, flowers yellow, calyx, a 5-toothed rim, petals ovate, entire involute, disk depressed, fruits tapering, compressed, broad, mericarps compressed at the back with 5 smooth ridges, thick at the base, ending in membranous wings; vittœ numerous.

ROYLE states that LIEUT. BURNES crossing in the direction of ALEXANDER'S route, found this plant, "the *prangos*," greedily cropped by sheep, and even eaten by his fellow travellers, and he supposes it to be the *Sylphum* described by ARRIAN as growing only with pines on Paropamesus. HEEREN applies the greater portion of the remarks that remain of Clesias respecting the Indians to the high land of Tartary, where grew the *Sylphium*, grazed on by innumerable flocks of sheep and goats.

DR. JAMESON, in his Catalogue of plants says, that it is called "prangos," from its Thibetian name, and that this plant is much used in Thibet to feed cattle, and is said to destroy the liver fluke in sheep. It grows wild at Mussoorie, but does not thrive in the plains.

DR. LINDLEY also writes that the leaves are dried, and used as winter fodder for cattle. Its effects are heating, producing fatness quickly. MOORCROFT.

This plant is also mentioned by HOOKER in his Flora Indica, as being abundant in the Dras valley, on the north of Kashmír.

The following letter is extracted from one of the

early numbers of the A. H. Society of India's Journal. The volume is rare, and the information will be acceptable no doubt to some.

"Wishing to employ as usefully as possible the time I am compelled to wait for the final answer of the Chinese authorities of Elela, to my representation, I lately undertook a journey to Imbal or Droz, for the purpose of examining into the reported qualities of a plant produced in that neighbourhood, and of which the accounts I had received seemed to border on exaggeration.

"This plant, called "prangos," is employed in the form of hay as a winter fodder for sheep and goats, and frequently for neat cattle; but its seed when eaten by horses is said to produce inflamation of the eyes and temporary blindness.

"During a stay at Imbal of nearly a month, in which I was occupied principally in acquiring an acquaintance with various details respecting the plant, I drew up a letter on this subject to the Secretary of the Board of Agriculture of Britain, which I propose to request the favor of having forwarded under cover to the Chairman of the Honorable the Court of Directors. And the whole will be transmitted to your address with the envelopes unsealed, should you think proper to examine their contents.

"The properties of "prangos" as a food appear to be heating, producing fatness in a space of time singularly short, and also destructive to the *Fasciola hepatica*, or liver fluke, which in Britain after a wet autumn, destroys some thousands of sheep by the rot, a disease, that to the best of my knowledge, has in its advanced stages hitherto proved incurable.

"The last mentioned property of itself, if it be retained by the plant in Britain,—and there appears no reason for suspecting that it will be lost—would render it especially valuable to our country.

"But this, taken along with its highly nutritious qualities, its vast yield, its easy culture, its great duration, its capability of flourishing on lands of the most inferior quality and wholly unadapted to tillage, impart to it a general character of probable utility unrivalled in the history of agricultural productions.

"When once in possession of the ground, for which the preparation is easy, it requires no subsequent ploughing, weeding, manuring, nor other operation, save that of cutting and of converting the foliage into hay.

"Of its duration I have two facts, viz., one of its seeds having been carried westward along with those of yellow lucerne, above forty years ago, sown on the Eastern frontier of Kashmír, where they vegetated, and of which the plants of the first growth still remain in a flourishing condition. In the second instance the seeds were transported eastward, and sown upon rocks near Molbee, where their plants flourished for about forty years, but in consequence of a long period of drought, during which there fell scarcely either rain or snow, the "prangos" perished along with the crops of that district in general.

"From various facts it is conceived not unreasonable to presume that by the cultivation of this plant, moors and wastes hitherto uncultivated, and a cause of disgrace to British Agriculture, may be made to produce large quantities of winter fodder, and that the yield of highlands and of downs enjoying a considerable depth of soil may be trebled.

"I have made every precautionary arrangement in my power, by presents, &c., for gathering, drying, packing and transporting a large quantity of the seed, and have left Mr. Guthrie, the Apothecary, to superintend their operations; one cask will be transmitted through Kashmír, and two others through Busahir, to your address.

"As the 'prangos' has hitherto been of spontaneous growth alone, practices better adapted to the nature of the plant or of the country may be adopted at a future time, but from a view of its habitudes in its wild state, I venture to suggest that the seeds be dibbled singly into holes an inch deep and a foot apart, a short time before the rainy season.

"During three years the plants will be little productive, but in that interim they will not be in the way of any other surface crop."

1300. Sium sp——? *Vern.*—Shakákal.

(1496) Amritsar.
(1927) Lahore.
(2298) Kashmír.

Used in special diseases only. Dr. Stewart has proved that some specimens of shakákal are the root of a species of *Convallaria*.

Dose.—6 máshas. Price, 2 rupees a seer.

1301. Narthex assafœtida. *Vern.*—Hing; angúza; kashim or masham (?).

ROOT.

(1040) Delhi.
(1307) Jálandhar.
(1926) Lahore

In masses of whitish tears, it becomes pink and then red on exposure; the smell is strongly alliaceous. It contains volatile oil, resin and gum. Used as a condiment with food; also as a medicine for indigestion, cholic and rheumatism. Considered to be very warm and pungent; also in special diseases. Said to be emmenagogue, and to produce abortion.

Dose.—1 másha, or grains 5 to 20. Price, 1 rupee a seer.

The plant is a native of Kashmír, Persia and Afghánistan.

The portion of the root exhibited came from the most southern habitat of the plant at present known, this being the Chenab valley, near Pangí.

The leaves are considered sudorific and carminative. The drug is extensively used as an antispasmodic stimulant in asthma, hysteria, and epilepsy. Assafœtida is the most powerful of the fœtid gum resins, it acts as a stimulant nervine tonic; and is also an expectorant and anthelmintic; it is largely used in hysteria and nervous affections; also in cholic, dyspepsia and hooping cough, in asthma, chronic bronchitis and palpitation of the heart; it is said to destroy round worm and the guinea worm, in doses of from grains 10 to 30. Used by hakíms to disperse indurations, and to carry off urine and to promote menstruation.

1302. Opoponax chironum. *Vern.*—Jawáshír. (*See* under Gums.)

(1184) Ludhiana.

(1926) Lahore.

Antispasmodic and stimulant like assafœtida. It is used by hakims in uterine affections, flatulence, cholic, convulsions, discharges and indurations.

1303. Angelica sp———. *Vern.*—Chora. Simla (root).

A cordial and stimulant remedy; it was formerly much employed in the treatment of flatulency and dyspepsia; also in special diseases. It is also used in obstinate constipation, flatulency, and bilious complaints; and in dyspepsia after fever.

1304. Dorema ammoniacum.* *Vern.*—'Ushak, or simagh-bil-shírín (Pers.)

(1001) Delhi.

Used in coughs. It is usually in small globular masses, pale yellow externally, white within, and smooth. It contains volatile oil, resin, and gum. A fœtid gum resin, similar in its action to assafœtida: it acts as a stimulant and expectorant, especially useful in chronic, catarrh, and asthma. Also externally as a stimulant discutient to indolent tumours. The hakíms use it in epilepsy, stoppage of urine, and menstruation; as also in tumours. It is said to produce abortion.

Dose.—1 to 2 máshas, or 5 to 10 grains.

RUBIACEÆ.

1305. Rubia munjista. *Vern.*—Manjíth; majíth.

(1916) Lahore (imported).

A cold and dry remedy; used for purifying the blood; used as a dye. It is said to be useful in poison, swelling, eruptions, boils, leprosy, and dysentery. Also employed in deficient menstruation and dysmenorrhœa as a tonic and emmenagogue, and as a deobstruent after parturition.

Price, 4 annas a seer.

1306. Randia dumetorum. *Vern.*—Maiñphal; rárá.

(671) Gurgaon.

(1505) Amritsar.

(1978) Lahore.

(2292) Kashmír.

Fruit about the size of a nutmeg, containing strong smelling seeds. A warm and dry remedy; used in cholic, and as an application to swellings. The fruit is said to destroy fish, and also to act as a powerful emetic and intoxicating agent; but this is doubtful.

Dose.—1 másha. Price, 2 annas a seer.

1307. Gardenia sp———. *Vern.*—Hab-il-ás.

(1914) Lahore.

(2237) Dera Ghází Khán.

The berries of this plant are sometimes confounded with the fruit of the juniper, properly called "hauber," which they resemble in appearance, but are longer and narrower, and show above the 5 sepals of the superior calyx, instead of the 3 or 4 bracts prescribed by the true juniper berries. It is said to be cathartic and anthelmintic.

DIPSACACEÆ.

1308. Morina Wallichiana? *Vern.*—Bekh ahmar.

(2398) Kashmír.

VALERIANACEÆ.

1309. Nardostachys jatamansi. *Vern.*—Bálchir; jatámási; samb-ul tíb.

(697) Gurgaon.

(1063) Delhi.

(1272) Jálandhar.

(1342) Hushyarpúr.

(1897) Lahore.

(2396-2462) Kashmír.

A warm remedy, acting as a stimulant perfume. The spikenard probably of the ancients. Used to scent and clean the hair; also in medicine as a stimulant and antispasmodic. Employed in jaundice, affection of the throat, and as an antidote for poisons; and it appears to be very valuable in hysteria and epilepsy, dyspepsia, cholic, and delirium tremens.

1310. Valeriana Wallichiana. *Vern.*—Dálá; wálá; † bálá; char; bálá mushk; char godar; also probably tagir or takar.

* *Ferula orientalis* of some writers.

† I doubt whether those names are both correct: one is more likely to be a mistake arising from the similarity of the Persian letters "w" and "d."

(1342) Hushyarpúr.
(2012-2046) Lahore.
Kashmír.
An aromatic stimulant and antispasmodic: useful in hysteria, epilepsy, hypochondrasis; and, occasionally, intermittent fever.
Dose.—15 to 30 grains.
Asárún is said to be also a name for "takar," and there is no doubt that the specimens called "asárún" were really the same as "wálá."
(1002) Delhi (tagar).
(1997) Lahore (asárún).
(2401) Kashmír.
It is considered by natives hot and moist, and to be useful in epilepsy, delirium, affections of the eyes, and to act as an antidote for poisons.
Dose.—2 máshas. Price, 6 annas a seer.

COMPOSITÆ.

1311. Lactuca sativa. *Vern.*—Kahú; khas ká bíj (??)
(639) Gurgaon.
(1023) Delhi.
(1152) Ambálah.
(1165) Ludhiana.
(1292) Jálandhar.
(1451) Amritsar.
(1907) Lahore.
(2442) Kashmír.
Pattiala.
Dose.—6 máshas. Price, 5 annas a seer.
Very cold remedy. It is used by natives as a demulcent only. By Europeans it is employed occasionally as an anodyne, similar to opium, but much weaker; also acts as a purgative and antispasmodic, and is said to be anti-aphrodisiac. Its juice contains a crystalline substance, lactucerine. In European practice it is used as an anodyne in phthisis, rheumatism, and gout—the inspissated juice is an anodyne and diaphoretic and diuretic in dropsy, rheumatism and hooping cough.
Dose.—Grains 8 to 30.

1312. Cichorium intybus.—Chicory or succory. *Vern.*—Kásní.

FRUITS.

(640) Gurgaon.
(1055) Delhi.
(1157) Ambálah.
(1167) Dera Ghází Khán.
(1260) Jálandhar.
(1337) Hushyarpúr.
(1414) Amritsar.
(1596) Gurdaspúr.
(1905) Lahore.
(2175) Rawalpindi.
(2195) Gújrat.
(2218) Jhílám.
(2233) Muzaffargarh.
(2257) Dera Ghází Khán.
(2446) Kashmír.
(2497) Jhind.

ROOT.—Bekh kásní.

(1490) Amritsar.
(1270) Jálandhar.
(1706) Lahore.
(2404) Kashmír.
The fruit is a cold remedy; used for fever and headache, also for jaundice. It is said to act as a purgative and cholagogue.
Dose.—6 máshas. Price, 3 annas a seer.
The root is used as a tonic and demulcent in fever and dyspepsia, and is largely used to adulterate coffee in England.
Dose.—6 máshas. Price, 2 annas a seer.

1313. Sonchus orixensis. *Vern.*—Bhangra; kálá bhángra; dughdika; sahadeví bari (H.); jángli tamáku (?).
(1955-2065-2164-1991) Lahore.
Similar to Lactuca in its properties.

1314. Senecio? *Vern.*—Sadbagh, or sadbarg.
(2305) Kashmír.
Used in coughs and asthma.

1315. Centaurea behmen. *Vern.*—Báhman súrkh or lál; báhman safaid.
(1901) Lahore.
A root which comes from Kábul; useful in special diseases. A bitter tonic and purgative; used in special diseases and as a substitute for "rhubarb." Used by hakíms as aromatic and aphrodisiac. The red kind, "báhman lál," is said by some to be the root of the *Salvia hæmatoides.*
Dose.—6 máshas. Price, 4 annas a seer.

1316. Carthamus tinctoria. Safflower. *Vern.*—Kusumbha; kúsam; má'sufir.
SEEDS. Hab-ul-kurtum (Arab.); poliyáñ; hab-ul-zulm.
(1262) Jálandhar.
Amritsar.
(1899) Lahore.
Delhi.
(1175) Ludhiana.
(2273) Dera Ghází Khán.
(2469) Kashmír.
The fixed oil is useful in rheumatic affections and in paralysis. The seeds are laxative, and the dried flowers are said to cure jaundice. The petals contain a peculiar acid carthamic acid, which, when mixed with powdered talc forms rouge; and with carbonate of soda,

card rouge, which is colorless till applied to the skin. The petals are used as a rose-colored dye and to adulterate saffron. The seeds are used in diseases of the bladder and gravel, on account of the doctrine of signatures; also said to be aperient and emetic; They yield a clear and useful oil.

Dose.—6 máshas. Price, 4 annas a seer.

1317.—Carthamus oxyacantha. *Vern.* —Karar; poliyáñ.

(1908) Lahore.

1318. Carduus nutans. *Vern.*—Gul-i-bádáwurd.

(2319) Kashmír.

Used to purify the blood.

1319. Aucklandia costus. *Vern.*—Kut; kust-talkh.

(1082) Delhi.

(1329) Jálandhar.

(1503) Ambállah.

(767) Amritsar.

A bitter aromatic tonic used in fever; formerly used in Europe, but not at present, called "putchuk" root; the roots have a pleasant smell, and are used as perfumes.

I here take occasion to extract from the proceedings of the Agri.-Hort. Society, a report from Dr. Johnstone of Gújrat, respecting "kut," &c. :—

"Pachak root is brought from Lahore, where it is called 'kut.' It is of unknown origin. It is chiefly exported to China, where it is used as an incense." Bengal Dispensatory, page 692.

"*Iris Florentina* yields orrice root. It finds its way to India, where it is called 'bekh-banafsha'—violet root—costus of the ancients,—'kut' and 'pachak' of the natives, is often called orrice root in North West India." Royle's Manual, page 618.

"'Bekh-banafsha' and 'pachak' root are imported from Kashmír." Honigberger's Thirty-five years in the East, page 292.

"The *Costus arabicus* of the ancients has almost sunk into oblivion, possibly owing to the uncertainty of its origin and ignorance of its virtues. When in Kashmír, last year, I endeavored to trace it, and after toiling up many a rugged mountain pathway, was rewarded: but the root-stock alone existed buried in snow which clothed its habitat so late as June. Leaving the valley, I directed two intelligent servants, one on the Indus, the other on the Punjab side of Kashmír, to wait until it had bloomed and was seeding. Owing to the unusual severity of the season, a good collection of plants was not obtained until the end of September. Eight of those were carefully removed, imbedded in their natural soil, and safely landed at Gújrat on 28th ultimo, when I replanted them.

"The costus is the 'kut' of the Kashmíris, the 'pachak' of Hindústán."

From the above quotations it will be observed that the "kut" is recorded as of unknown origin in the Bengal Dispensatory. In Mr. Davis' report on the Trade and Resources of North West India in the last Appendix, the "kut" is recorded as *Aucklandia veracosta*.

Dr. Royle leads one to infer that "kut" and "pachak" are identical with orrice root. Dr. Honigberger notifies "bekh banafsha" and "pachak" root as separate exports from the Kashmír valley. I find that "kut" in Dr. Jameson's report on the Botanical Gardens of the North West Provinces, 1865, figures as the *Aucklandia veracosta*, with a reference to Endl. Gen. plant: p. 468, which I have no opportunity of consulting. Dr. Royle in the introduction to his large work, questions on Moorcroft's authority, if the *Aucklandia* is the veritable "kut."

The *Iris Florentina*, which yields orrice root, is entirely distinct from the Kashmír variety, which luxuriates over every grave, and blooms on many a housetop in the far-famed valley, a custom by the way resembling that of the ancient Greeks, who venerated the *Iris* as the messenger between God and Man. The white, blue, and yellow flowers cover the brow of the dancing girls as they did the Hebrew choristers in ancient Egypt.

I cannot endorse the statement that "Bekh-banafsha" is the orrice root, much less that "kut" and "pachak" are often called orrice root. It may be so in Calcutta, it is not so in Kashmír, or the Punjab, and any where it is a misnomer. "Bekh-banafsha" is the root of the *Viola repens*, generally prescribed by the Kashmír hakims as an emetic. The rhizome of the fleur-de-lis is retailed by the pansárís as *Kutta ka bij*, the (Warch) root of *Acorus calamus*, as a spurious "kut." Mir Muhamad Hussein, in his Materia Medica, p. 494, mentions *kut, talkh* and *shirin*, the former the young, the latter the old, root. It is just the opposite.

The "kut" is not found in the Kashmír valley, but on the Southern slopes of the surrounding mountains, at a minimum elevation of about 7,000 feet above the sea, and where snow lies during the winter.

As the snow melts in the end of March, the root stock appears, its caudal leaves develope in the beginning of June, and it comes to full fruition in September. It belongs to the *Cynaracephalæ*, a suborder of the *Asteraceæ (Compositæ)*, is a perennial, leaves and stems dying yearly to root stock, the exstipulate caudal leaves rise in threes, the two lateral spathing the centre, the centre sheathing the stem as it shoots above ground.

The stem, two or three of which may arise from

root stock, stands in adult growth 40 inches, is fluted, lined internally with pith, and sheathed with exstipulate tristichous leaves.

The root stock varies in size from 9 to 15 inches in length, and from 3 to 21 inches in thickness, the caudal leaves spring straight from root-stock, and are supported on petioles 18 inches long, the leaves are simple abcordate 8 by 5 inches in adult growth strongly veined, and resemble that of the "káshí phal," or "Benares kadú."

The officinal part of the "kut" is the root stock. It is used by the Kashmír hakíms.

1. Dried and powdered as the principal ingredient in an astringent stimulant ointment applied to severe ulcerations.

2. Dried and powdered as a hair-wash.

3. As a stimulant in cholera, an infusion is made of

Cardomoms,	1 drachm	one ounce every half hour.
Fresh "kut,"	3 „	
Water,	4 ounces	

It is doubtless a powerful aromatic stimulant, and would be serviceable in any spasmodic disease.

4. It is universally employed by the shawl merchants, as a mechanical (?) protector of Kashmír fabrics from the attacks of moth and other vermin.

5. The dried root is an agreeable fumigatory, and yields excellent pastilles which burn fairly.

6. It is exported, in enormous quantities, to China, where it is used as an incense. Lines of camels may often be met passing down to Múltán, the "kut" perfuming the air for a considerable distance; in every Hong it is found; no mandarin will give an audience until the "pachak" incense smokes before him; in every joss-house it smoulders before the Tri-Budh Deity, in every floating junk in the Chinese rivers, the only home of countless hordes, Budh's image is found, and the smoke of the "pachak" religiously wends its way heavenward; with the bulk of the Chinese, this ceremony is regarded as sufficient to propitiate the Gods, while their merchants by substituting a spurious pungent article, endeavor even to mephitise their blurred and frouzy deity.

7. It is a crown monopoly, each village in the vicinity of the "kut" fields is assessed a fixed amount yearly, which must be delivered in the capital; the MAHARAJAH'S agents buy up the surplus at one maund per *chilki* rupee, and retail it at double rate.

1320. Gnaphalium sp——. *Vern.*—Bál raksha (H.)

(2057) Lahore.

Flowers said to be astringent and diaphoretic.

1321. Doronicum scorpoides? *Vern.*—Darúnaj-'akrabí.

(1481) Amritsar.

(1902) Lahore.

Used in special diseases. The roots are aromatic tonics, and are said to be used to prevent giddiness on ascending heights.

Dose.—3 máshas. Price, 6 rupees a seer.

1322. Vernonia cinerea. *Vern.*—Kák jangi; sahádevi barí (H.)

(2082-2164) Lahore.

Said to be a powerful anthelmintic. All the parts of the plant are very bitter: used as a diaphoretic in fever. AINSLIE.

1323. Microlonchus divaricata. *Vern.*—Biramdandí; rathmandi; barhandi?

(656) Gurgaon.

(1854-1977) Lahore.

Considered by natives hot and dry. Used in special diseases. Used to purify the blood.

Dose.—6 máshas. Price, 4 rupees a seer.

1324. Carpesium. *Vern.*—Hukm andáz.

(2468) Kashmír.

1325. Matricaria chamomilla. *Vern.*—Bábúnah.

(1075) Delhi.

(1186-1190) Ludhiana.

(1293) Jálandhar.

(1548-1429-1572) Amritsar.

(1911) Lahore.

(2189) Gújrat.

(2271) Dera Ghází Khan.

(2324-2415) Kashmír.

Jhílam.

Pattiala.

It contains a volatile oil and bitter principle. Used by hakíms in affections of the brain, inflammation, swellings, and pains. Used both externally and internally in fever, as a tonic and febrifuge. Might be used as a substitute for *(Anthemis)* chamomile flowers, in dyspepsia, flatulency and intermittents as an aromatic tonic and carminative. It was formerly used for chinchona.

Dose.—3 mashas. Price, 1 rupee a seer.

1326. Spilanthus oleracea? *Vern.*—'Akarkarhá; pokarmúl.

(1054) Delhi.

(2005-2006) Lahore.

(1526) Amritsar.

Considered by natives a powerful stimulant and sialogogue: useful in headache, paralysis of the tongue, affections of the gums and throat, and for tooth-ache; also in fever, coughs, and special diseases. It is used as a substitute for the Pellitory of Spain, *Pyrethrum* root, which increases the secretion of saliva, by its local irritant action, and is principally used by Europeans in toothache and paralysis of the muscles of the mouth.

Dose.—6 máshas. Price, 1¼ rupee a seer.

1327. Artemisia indica. Wormwood. *Vern.*—Afsantín ; mastárú (H.)

(1478) Amritsar.

(1910) Lahore.

(2338-2378) Kashmir.

It contains volatile oil and bitter extractive matter. Used as a tonic in fever and debility; also to flavor spirits and essences.

Dose.—8 máshas.

Also used as an antispasmodic in hysteria. A valuable bitter tonic. Might be used as a substitute for chinchona, although inferior in intermittent fevers; also employed in dyspepsia and as an anthelmentic, and in liver diseases.

Dose.—Grains 20 to 40.

1328. Artemisia scoparius. *Vern.*—Churi saroch.

(2613) Lahore.

The flower spike when dry has a pleasant smell. Used for purifying the blood, and in indigestion.

Price, 2 annas a seer.

1329. Artemisia elegans. *Vern.*—Dandtí or dantí.

(2071) Lahore.

All the different species of *Artemisia* are aromatic bitter tonics, and most of them have anthelmintic properties; they contain an essential oil, a bitter principle called absinthine, and a peculiar acid.

They are principally used in intermittent fever, for intestinal worms, and in dyspepsia; also in epilepsy and chorea.

Dose.—1 to 2 drachms of the powder.

1330. Sphœranthus mollis. *Vern.*—Múndí ; mundí búti ; guruk mundi ; zakhm haiyát.

(652) Gurgaon.

(1134) Hissar.

(1404) Amritsar.

(1583) Gurdaspúr.

(1944) Lahore.

(2284) Kashmír.

(1410) Amritsar (herb, zakhm hyát).

Considered a warm remedy : used in special diseases. Flowers used in skin diseases, and for purifying the blood. The roots are considered anthelmintic.

Dose.—6 máshas. Price, 12 annas a seer.

1331. Myriogyne minuta. *Vern.*—Nakchikní.

(694) Gurgaon.

(1229) Jálandhar.

(1438) Amritsar.

(1808-1861) Lahore.

(2358) Kashmír.

Considered by natives hot and dry : useful in paralysis, pains in joints, and special diseases; also as a vermifuge. It promotes sneezing, hence its vernacular name.

1332. Serratula anthelmintica. Blue flea bane. *Vern.*—Kálí zírí (or kálá zira); bukokí?? kakshama (S.); malwa bakchí (H.)

(647) Gurgaon.

(1058) Delhi.

(1149) Ambálah.

(1501) Amritsar.

(1568) Gurdaspúr.

(1361) Hushyarpúr.

(1192) Simla.

(1182) Ludhiana.

(2082) Lahore.

(2217) Jhilam.

(2312) Kashmír.

Pattiala.

(*See* Carum).

A cold remedy. Used by natives for fever and skin diseases, and against worms. Acts as a bitter tonic and anthelmintic; and is recommended by Mr. Minas in the treatment of skin disease, especially in porrigo and lepra. Considered a very valuable remedy for prolonging life, and restoring youth; also to prevent the hair turning gray : it is vermifuge, cures boils and eruptions of the skin; and also special diseases. It is said that fleas disappear if this plant is roasted in the room, or its powder strewed on the floor.

Dose.—6 máshas. Price, 2 annas a seer.

1333. Chrysanthemum indicum. *Vern.*—Gul dúdí or dáúdí. (David's flower).

(1909) Lahore.

Considered by natives hot and dry : useful in affection of the brain and calculus, also to remove depression of spirits.

1334. Xanthium strumarium. *Vern.*—Gokru? khagarwal?

(1869-2076) Lahore.

Root acts as a bitter tonic, and is said to be useful in cancer and strimous diseases.

1335. Bertholetia lanceolata. *Vern.*—Rai saná.

(1015A) Delhi.

1336. Tagetes erecta. *Vern.*—Sadbargí.

(1832) Lahore.

(2334) Kashmír.

Used in diseases of the eye, and to purify the blood; the flowers are sometimes used to dye yellow.

1337. Eclypta erecta. *Vern.*—Bhangra; dodak; nigand; bamárí (?)

(1956-1962) Lahore.

(1461) Amritsar.

Simla.

Juice used to dye hair black; also in elephantiasis. It is considered by natives hot and dry. It is said to cure leprosy if dug up on the first day of the week, and dried in the shade; and also if eaten for six months, that it turns the hair black, especially if applied externally.

COROLLIFLORÆ.

ERICACEÆ.

1338. Rhododendron campanulatum. *Vern.*—Kashmírí patr; talís patr; níkú (Kashmírí).

(1780-1694) Lahore.

(2360) Kashmír.

The leaves are said to be narcotic, and to intoxicate animals that eat them; and they are used as an errhine in headaches and severe colds. It is said to be useful in chronic rheumatism, syphilis, and sciatica.

Dose.—1 rati. Price, 4 annas a seer.

1339. Penœa sarcocolla. *Vern.*—Anjzarút.

EBENACEÆ.

1340. Diospyros cordifolia. *Vern.*—Banteudu.

(1333) Jálandhar.

A valuable astringent and styptic for fresh wounds; also occasionally in intermittent fever. The fruits furnish a kind of glue, used to cover the bottom of boats. The seeds yield oil.

STYRACACEÆ.

1341. Symplocos cratœgoides. *Vern.*—Lodar, patháni sarhá (?)

(1523) Amritsar.

(1839) Lahore.

Leaves said to be astringent.

1342. Styrax benzoin. *Vern.*—Lúbán.

(1039A) Delhi.

In masses composed of white lumps—joined together by a brownish red substance. It has an agreeable odour and taste. It contains a resin mixed with a considerable quantity of benzoic acid, which may be prepared from this drug, either by boiling it with a solution of carbonate of soda, and precipitating it by hydrochloric acid, or simply by subliming it in a vessel divided by blotting paper placed transversely across the middle. A very useful stimulant, expectorant, and diuretic. It is principally used in chronic bronchitis and laryngetis; also in jaundice and disease of the bladder. The vapour of it when burning is said to be useful as a local application in hœmorrhoids: also as a cleansing agent for the hair.

Dose.—Grains 10 to 30.

OLEACEÆ.

1343. Olea ferruginea. *Vern.*—Kahu or káú; zaitún.

(1849) Lahore.

Leaves and bark bitter and astringent; used as an antiperiodic in fever and debility. Fruit contains a little oil.

1344. Fraxinus floribundus. (Manna). *Vern.*—Sherkhist; shaklú.

(1031) Delhi.

(1982) Lahore.

(2260) Dera Ghází Khán.

The purest kind of Indian manna. It occurs in small reddish white pieces. It is used as a demulcent and laxative in fevers, pulmonary affections, cholic and vomiting.

JASMINEACEÆ.

1345. Jasminum grandiflorum.

FLOWERS.—Chambeli, chamba, jati.

(1552) Amritsar.

(1874) Lahore.

(2357) Kashmír.

Considered by natives a bitter and cool remedy: employed as a perfume; also as an application to wounds, ulcers, boils and eruptions of the skin; also in headache, and to cure disordered eyesight. The leaves are said to cure toothache and pain in the eyes, and the juice of the root to relieve suppression of urine. It acts as an aromatic stimulant, and might be used as a substitute for *Sambucus*, elder flowers.

1346. Jasminum revolutum. *Vern.*—Malto; pitmalti (Hindi).

(2137-2103) Lahore.

It contains an essential oil of an aromatic flavor, and is used as a perfume. The root is said to be useful in ringworm.

1347. Jasminum zambac. *Vern.*—Motyá.

(994) Delhi.

(1552) Amritsar.

(1873) Lahore.

Considered by natives cool and sweet: used as a remedy in cases of insanity; in weakness of sight, and affections of the mouth. The flowers are considered sacred by Hindús; and are employed as a perfume, as they contain an aromatic essential oil.

1348. Nyctanthes arbortristis. *Vern.*—Harsinghár; sítal; dúdhiká (H.); hadhjorá.

(1005) Delhi.

(1875-2135) Lahore.

Pattiala.

Used as a dye and perfume. Considered by natives

cool and light, and used in ringworm, and to reunite broken bones, hence one of its native names, "had-jora." It is also employed in disorders of the wind, mucus, and bile; and in special affections. It is very aromatic, and contains essential oil. It also would form a substitute for *Sambucus*.

EHRETIACEÆ.

1349. Heliotropium brevifolium.

Vern.—Chiti mirák (Deraját); chittiphúl.

(2238) Dera Gházi Khán.

(2014) Lahore.

The herb is said to be laxative, and diuretic: the seeds are emmenagogue. The juice of the leaves is considered warm and bitter. It is used by natives as an application to gumboils and in ophthalmia, especially of the tarsus; also to clear wounds and ulcers. It is said to relieve the pain caused by the sting of a scorpion.

LOGANIACEÆ.

1350. Strychnos nuxvomica.

Vern.—Kuchila; hub-ul-jaráb; kágphala? (said to be called azráki in Persian, and falús máhi and khának-ul-kalb in Arabic).

(1043) Delhi.

(1290) Jálandhar.

(1844) Lahore.

The seeds are disk-shaped, circular, hard and thorny, of a gray color, covered by a silky down, composed of thickset simple hairs, containing a large bilobed albumen, and a small embryo with distinctly veined cotyledons. It contains two powerfully poisonous alcaloids, strychnine and brucine, and an acid. It acts as a powerful excitor of the spinal chord, and as a tonic. By Europeans it is principally used in paralysis and neuralgia; also in muscular tremors and incontinence of urine. It is occasionally used in dyspepsia, diarrhœa and dysentery, and with purgatives in constipation; likewise in fever instead of quinine, and to check vomiting. By natives it is considered hot, that it strengthens the system, and turns white hair to black. It is used externally to rub paralysed parts. Internally it is employed in paralysis, vomiting, cholic and dropsies.

Dose.—1 to 3 grains.

1351. Strychnos faba S. Ignatii.

Vern.—Papita.

(1000) Delhi.

(1843) Lahore.

Seeds of a reddish brown color, about the size of almonds. It contains strychnine and a little brucine. It has only lately been used in India, but is employed as a tonic in cholera, ague, and as a vermifuge; also in vomiting, pain in the stomach, and diarrhœa, but it is said to be most useful as an antidote to the bites of serpents and to narcotic poisons, even when the patient is insensible. It is also worn as an amulet to prevent scurvy. In European medicine it is used instead of *Nuxvomica* but in a smaller dose, as it contains three times the proportion of strychnine. It is especially useful in dyspepsia and cholic.

1352. Strychnos potatorum.

Vern.—Nirmalí.

(1842) Lahore.

Used to purify water by rubbing the cut seed on a rough earthen vessel, so that the expressed juice mixes with the water, on allowing the water to stand most of the impurities in suspension subside. In this process the gelatinous matter of the seed at first mixes with the water, but afterwards combines with the lime salts, and both become insoluble, and are precipitated, carrying with them the matters held in suspension. It is said that almonds used in a similar way will also clear water. It is considered by natives a cool and dry remedy, useful in dysentery, snake bites, and to strengthen the eyesight; also in special diseases. It is said not to be at all poisonous, but that the young fruit acts as an emetic.

APOCYNACEÆ.

1353. Nerium odorum.

Oleander. *Vern.*—Kaner; gandara; karber; shwet kaner (H.), (white variety); rakt kaner or karbir (red kind).

(1841) Lahore (leaves and roots).

(1832) Jálandhar (gandíra).

(2119) Lahore (white).

(2081) Lahore (red).

(2129) Lahore (leaves).

The roots contain a yellow poisonous resin, tannic acid, wax and sugar, but no alcaloid or volatile poison. The bark and flowers contain the same poisonous resin which is most abundant in the liber or inner bark; it is very soluble in carbonate of soda, and though not volatile is carried over mechanically when the plant is distilled with water.

It is considered by the natives hot and poisonous: it is used in leprosy, eruptions of the skin and boils; also to remove worms.

1354. Cerbera manghas.

Vern.—Pílí karbír; kaner zard.

(2136) Lahore.

The leaves and the bark act as purgatives, and resemble senna; and the milky sap is also purgative. The seeds are said to be powerfully narcotic and poi-

sonous, producing delirium, and resembling datura. (AINSLIE).*

1355. Wrightea antidysenterica. Conessi bark. *Vern.*—Indarjau shirín; andusarún (of Yunáni writers); lisán-ul-ásafír (Ar.); tiwaj (?)

(650) Gurgaon.
(1213) Simla.
(1840) Lahore.
(2381) Kashmír.
Pattiala.

Said by natives to be hot bitter and astringent: used in fever, dysentery, and debility; also in piles, and as an anthelmintic for tape-worm.

Dose.—3 máshas. Price, 8 annas a seer.

1356. Holarrhena antidysenterica. Tellichery bark. *Vern.*—Indarjau talkh.

(1321) Jálandhar.

A broader seed than the former. Said to resemble the "indarjau shirín" in its action. It acts as a bitter vermifuge and antispasmodic, and is used in dysentery, cholera, and tape-worm; also externally to rub over rheumatic joints.

1357. Carissa diffusa. *Vern.*—Mardak.

(2917) Lahore.

1358. Rhazia stricta. *Vern.*—Sauwár.

(2262) Dera Gházi Khán.

I found this growing all over the hill sides at Attock, where it was called "ganira."

1359. Ophioxylon. *Vern.*—Chándrikí-kájar.

(2017-2019) Lahore.

The root is said to be a bitter tonic and febrifuge and also purgative. It is especially used by natives in cases of poisoned wounds from serpents and scorpions; also in fever, and to promote delivery in tedious labors.

ASCLEPIADACEÆ.

1360. Calotropis procera. *Vern.*—Akh (Pji); ák (Hind.); akund, ark? (H.); madár; kabar ki jar (the root); taghár (the manna).

(1113-1014A) Delhi.
(1265) Jálandhar.
(1189) Ludhiana.
(1157-1858) Lahore.
(1859) Lahore (flowers, gul madár).
(1951) Lahore (kabar ki jar, or bekh kibr (root).

The root bark is said to be diaphoretic and expectorant; also a purgative and emetic. It is used in European medicine to replace ipecacuanha, both as an emetic and for the cure of dysentery—twice the dose being given. It is also employed advantageously as a substitute for sarsaparilla in syphilis. By natives it is used in the treatment of leprosy, skin diseases and coughs; also in diseases of the liver and secondary syphilis. The fresh juice is employed as a rubefacient in rheumatism and chest disease, and the leaves are used for the cure of guinea worm.

1361. Manna from Calotropis. *Vern.*—Shakar taghár.

(1092) Delhi.
(1983) Lahore.
(2514) Amritsar.

Said to be the nest of an insect.

1362. Hemidesmus indicus. Indian sarsaparilla. *Vern.*—Anant múl.

(1860) Lahore.

It contains a volatile crystalline acid principle, called hemidesmic acid. It is extensively used in European practice as an alterative tonic and diuretic, especially as a substitute for sarsaparilla, which some consider it to exceed in efficacy. It is principally used in syphilis and skin disease, and in affections of the liver. It is not often employed by natives.

1363. Asclepias curassavica. *Vern.*—Káktundí.

(2090) Lahore.

Root acts as an emetic, but is less powerful than ipecacuanha; also as a purgative, and subsequently astringent. It is used in cases of piles and gonorrhœa; and is said to be so useful in the treatment of dysentery in Jamaica, as to be called "blood flower," there. (AINSLIE).

1364. Pentatropis sp——. *Vern.*—Ark pushp (Hindí).

(2056) Lahore.

GENTIANACEÆ.

1365. Ophelia chireta. Chiretta. (*Agathotes chiretta*). *Vern.*—Chiraita; hab-ul-múl; dawai-i-pechish.

(1135) Sirsa.
(1281) Jálandhar.
(1393) Amritsar.
(1004) Delhi.
(1360) Hushyarpúr.
(1522) Amritsar (called kiraita).
(1847) Lahore.
(2366-2847) Kashmír.

It contains a yellow bitter principle and a resin. It acts as a simple bitter tonic, not aromatic nor astringent; it is the best substitute for gentian and quassia. It is principally used by Europeans in fever, debility and dyspepsia. By natives it is con-

* I believe *Allamanda cathartica* is also called "zard kaner," and is occasionally used in native medicine.

sidered cool and dry, and is used in fever and skin diseases; also to purify the blood and in cough.

Various other plants are often mixed with it, and some of these contain tannic acid, and therefore precipitate salts of iron black.

The root is the bitterest part of the plant, and the bitter principle is easily imparted to water or alcohol. According to MR. BATTLEY'S analysis of its chemical properties, "it contains a free acid, a bitter resinous extractive with much gum, and chlorates, with sulphates of potass and lime. No alcaloid has been detected in it; what is therefore sold as a sulphate of chiraytine is well known to be only the disulphate of quinia." It is best recommended in preparation as an infusion or watery extract, or a tincture, but not in decoction; even infusion made with warm water is denounced as producing violent headache. To form a cold infusion, a pint of water should not stand more than twenty minutes on half an ounce of the bruised plant. "Chirayta possesses the general properties of bitter tonics, but has at the same time some peculiar to itself, which fit it well for certain forms and complications of disease. Unlike most other tonics, it does not constipate the bowels, but tends to produce a regular action of the alimentary canal, even in those subject to habitual constipation. During its use the bile becomes more abundant and healthy in character. The tendency to excess of acidity in the stomach, with disengagement of flatus, is much restrained by its use. These qualities fit it in a most peculiar degree for the kind of indigestion which occurs in gouty persons. It may, when necessary, be associated with alkaline preparations or with acids; the latter are generally preferable. The same remark applies to its employment in the treatment of scrofula. As a remedy against the languor and debility which affect many persons in summer and autumn, nothing is equal to the cold infusion of this plant. It may be taken twice or even more frequently daily, for a considerable time; then discontinued, and afterwards resumed. Children take it more readily than most other bitters. It is found to be a very efficacious remedy in India against intermittents, particularly when associated with *Guilandina bonduc* or Caranga nuts. The debility which is apt to end in dropsy is often speedily removed by infusion of chirayta, to which is added the tincture formed of it with orange-peel and cardamoms. Its efficacy in worm-cases has procured for it the name of worm-seed plant. The extract is given with great benefit in some forms of diarrhœa and dysentery, particularly if combined with ipecacuanha, the emetic tendency of which it very markedly controls."

Dose.—6 máshas. Price, 8 annas a seer.

1366. Picrorhiza kurrooa. *Vern.*—Karwá; kaur; pathánbed; káli kutki.

(1138) Sirsa.
(1208) Simla (DR. CLEGHORN).
(1506) Amritsar.
(2033) Lahore.
(2316-2426) Kashmír.
(1127) Delhi.

Considered a dry warm remedy, removing fever, gravel, and special deseases.

The term "kálí kutki" is stated in many books to denote black hellebore (*Helleborus niger*), an acrid purgative and poison; but others say that it does not really act as a purgative, and all the specimens sent to the Exhibition were evidently precisely the same as the specimens of "karwá."

Dose.—6 máshas.

1367. Gentiana sp——. *Vern.*—Jintyáná. ROOT.—Pakanbed or pathánbed; dawai-i-átshak. FLOWERS.—Gul-i-gháfish.

(1846-1848) Lahore.
(2283) Kashmír.

Used in fevers and rheumatism; also for diarrhœa and dysentery, and to purify the blood. It acts as a substitute for gentian, which is a pure better tonic: used in fevers, debility and dyspepsia.

Dose.—6 máshas. Price, 8 annas a seer.

SOLANACEÆ.

1368. Solanum indicum. *Vern.*—Kandyárí.

(1855) Lahore.
(1459) Amritsar.
(1006A) Delhi (bhat khatai).—See **S. xanthocarpum.**

The powder is applied to the head in headache.

1369. Solanum tuberosum. Potatoe. *Vern.*—Alú.

(1973) Delhi.
(2372) Kashmír.

A useful esculent, contains a large amount of starch, and when dried it is used as a substitute for salep.

1370. Withania coagulans. *Vern.*—Panír.

(2229) Muzaffargarh.

Said to be usefnl to coagulate milk.

Price, 14 seers per 1 rupee.

1371. Solanum nigrum. *Vern.*—Mako; 'anb-us-sá'lap, *i. e.*, fox's grapes (Arabic); pilak; kákmáchí.

(1238) Jálandhar.
(1424) Amritsar.
(1181) Ludhiana.
(1352) Hushyarpúr.
(1985) Lahore.
(1019A) Delhi.
(2255) Dera Ghází Khán (karbérí).

(2480) Jhínd.
(1556) Gurdaspúr.
(660) Gurgaon.
(2063) Lahore (kákmáchi).
(2306) Kashmír ('anb-us-sá'lab).

Considered by natives cool and moist: used in fever, diarrhœa, and ulcers; also in disorders of the eye-sight, and in hydrophobia, both externally and internally. It contains a small amount of solanine in the juice of the stem and berries, but it may be eaten as food, as in France.

Dose.—6 máshas. Price, 8 annas a seer.

1372. Solanum melongena. *Vern.*—Baingaṅ; bádanján (Pers.); buntaki (?).
(1226) Jálandhar.
(2403) Kashmír (bádanján bostání).
(2433) Kashmír (tukm-i-bádanján rúmi).

It is hot and dry: it is said to prevent sleep and produce unpleasant dreams, owing to vitiated bile. It is much used as a vegetable. Leaves are said to be narcotic: the berries have been called *Mala insana*, or mad apples.

1373. Solanum xanthocarpum. *Vern.*—U'nt katára; bhat khatai.
(1853) Lahore.
(1855) Lahore (called kaudyárí).

Considered to be an expectorant, and to be useful, in coughs, asthma, and consumption. AINSLIE.

1374. Solanum gracilipes. *Vern.*—Hálún; gágra.
(2047) Lahore.
(2241) Dera Ghází Khán (gágra).
(1090) Delhi (hálún).

1375. Solanum sp—— incerta. *Vern.*—Rúbabárík.
(1850) Lahore.

It contains a peculiar alcaloid solanine, and acts as a diaphoretic, diuretic and alterative; especially in skin diseases, as lepra.

1376. Withania somnifera. *Vern.*—Asgand nágorí; isgand; ashwa gandha (Sanskrit).
(1013) Delhi.
(669) Gurgaon.
(1521) Amritsar.

The leaves are bitter and narcotic, and are used in fever. The leaves as used as an application to carbuncles.

(1989) Lahore (asgand).
(2067) Lahore (vaman viréchan or daman, &c. (?) (Hindí medicine).

Root used as a diuretic and deobstruent, and also a narcotic. A long white root. When in perfection it is said to smell like a horse, whence the name (ashwa gandha). It is hot and dry, useful in special diseases and in swellings; it is said also to improve the complexion.

1377. Capsicum fastigiatum. Red pepper, common capsicum, Guinea or Chilli pepper. *Vern.*—Lál mirch.
(1048) Delhi.
(1318) Jálandhar.
(1396) Amritsar.
Pattiala.

A small conical orange-colored pod, shining externally; internally containing spongy pulp, and white flat reniform seeds in two cells. It contains a volatile neutral principle, called capsicine, and acts as an acid stimulant, and externally a rubefacient. It is used in putrid sore-throat, scarlatina; also in ordinary sore-throat, hoarseness and dyspepsia, and yellow fever; and in diarrhœa occasionally; also in piles.

1378. Datura alba. *Vern.*—Dhatúra safaid.
(2166) Lahore (various preparations of datura).
(1222) Jálandhar.
(1946-1032A) Delhi.
(2444) Kashmír.
(947) Dera Ghází Khán.

Seldom used in medicine, but occasionally employed as a poison. Considered by natives hot and useful in fever, poison and worms; also in itch, poisoning and nausea. Considered by Europeans a narcotic and antispasmodic; useful in asthma and gastrodynia.

Dose.—One tola weight would prove fatal. Price, 1 rupee a seer.

1379. Datura fastuosa. *Vern.*—Dhatúra.
(946) Dera Ghází Khán.
(1172) Ludhiana.
(1449) Amritsar.
(2444) Kashmír.

Used for coughs and asthma, also in special diseases; also applied extensively for stiff neck and rheumatism. It is considered more powerful than the white variety, and is often used as a poison. It contains an alcaloid called, daturine; and is used as a narcotic anodyne and antispasmodic, especially in cases of asthma, bronchitis and emphysema; also in insanity, in diseases of the eye and neuralgia and in rheumatism. Used to smoke in asthma, in doses of grains 10 to 20.

Dose.—1 rati. Price, 1 rupee a seer.

1380. Hyoscyamus nigra. *Vern.*—Khurásáni ajwain; tukhm-i-kasús.
(1112) Delhi.
(1019) Delhi (chauni jawain).
(1558) Gurdaspúr.
(1851) Lahore.
(1483) Amritsar.

A warm remedy. Used like dhatúra for cough and asthma, also to relieve pain in many diseases.

The whole plant contains a peculiar alcaloid hyos-

cyamia resembling atropia. It acts as a narcotic and antispasmodic, and is used as a substitute for opium. In coughs, phthisis, disease of the heart, in delirium, in blindness and brain disease; also in neuralgia and rheumatism.

Dose.—Half a rati. Price, 5 annas a seer.

1381. Nicotiana tabacum. *Vern.*—Tamáku.

(1218) Jálandhar.

(2360) Kashmir.

Said to be imported from England in the time of AKBAR. Supposed to be hot and dry, to weaken the brain, and depress the spirits, but to be useful in dispersing cholic and pyrosis. It contains a liquid poisonous alcaloid nicotine and a volatile oil. It acts as a powerful sedative; and is also diuretic, purgative and emetic. It has been used in cholic, strangulated hernia, and in dislocations; also in tetany, poisoning by strychnine, and spasmodic asthma. It is occasionally used externally in skin diseases.

1382. Nicandra indica. Winter cherry.—*Vern.*—Kákuaj.

(1012A) Delhi.

(1856) Lahore.

Said to be diuretic and purgative; useful in ulcerations of the bladder.

PEDALIACEÆ.

1383. Sesamum orientale. *Vern.*—Til; kunjad.

(1018-1086) Delhi (black).

(1893) Lahore (mixed).

(2427) Kashmír.

(1894) Lahore (Oil cake. The residuum after expresing the oil, called "khal.")

The seeds are used as food. It is considered by natives a warm dry remedy; used both externally and internally in rheumatism and boils. The black seeds are said to be the most powerful; next the white; and afterwards the red. They yield abundance of oil, called oil of benne, which is used both in food and medicine.

Dose.—2 tolahs. Price, 1 anna a seer.

1384. Pedalium murex. *Vern.*—Gokru bara; gokru dakbani.

(1221) Jálandhar.

(1578) Gurdaspúr (gokrú kalán).

(661) Gurgaon.

(2212) Jhilam.

(2225) Shahpúr.

(1083A) Delhi.

A useful demulcent and diuretic, especially in urinary diseases; it rapidly renders water mucilaginous. It is considered cool and tonic, and is used in special diseases, and urinary affections.

Dose.—6 máshas. Price, 8 annas a seer.

1385. Martynia diandra. *Vern.*—Háthajorí (H.)

(2083) Lahore.

VERBENACEÆ.

1386. Vitex trifolia. *Vern.*—Shambálú; rínga.

(1891) Lahore (seeds and leaves).

(2252) Dera Ghází Khán.

(1106) Delhi.

(1455) Amritsar.

Used in special diseases, and after parturition; also to produce appetite and increase the bile. Considered by the natives bitter and astringent; it improves the appetite, and is useful in boils, eruptions and leprosy. It is said to be useful as an external application for enlarged spleen; also in sprains, contusions, rheumatism, and contraction of limbs; also internally in fever and rheumatism. AINSLIE.

Dose.—8 máshas. Price, 6 annas a seer.

1387. Vitex negundo. *Vern.*—Nirgándi; níndi.

(2104) Lahore.

Leaves are useful in acute rheumatism, and intermittent fever and special diseases; also said to relieve headache and catarrh; also after confinement. The fruit is acid; its action is similar to that of the *Vitex trifolia*, but less powerful.

1388. Verbena sp——. *Vern.*—Chiraita.

(2320) Kashmír.

Said to be febrifuge; used as a rubefacient in rheumatism and diseases of the joints. The root is said to cure strumous diseases. It was considered to cure snake bites; and to be useful in many diseases. AINSLIE.

1389. Clerodendron siphonanthus. *Vern.*—Arnah; dawai-i-mubárak.

(1890) Lahore.

(2286) Kashmir.

Slightly bitter and astringent; yields resin. Employed in syphilitic rheumatism.

1390. Clerodendon infortunatum. *Vern.*—Barangí.

(2417) Lahore.

1391. Gmelina asiatica. *Vern.*—Badhára.

(1892) Lahore.

Used for rheumatism, pains in the loins, or special diseases.

Dose.—2 máshas. Price, 8 annas a seer.

1392. Gmelina arborea. *Vern.*—Chok.
(1504) Amritsar.
(1768) Lahore.
(2121) (Lahore kákodumri, H).
A warm remedy: used for coughs and asthma; also in rheumatism and as an anthelmintic. The root is said to be demulcent and mucilaginous; useful in pains in the joints and nervous diseases.

The *Gmelina parviflora* is said to be diuretic and demulcent, warming, and to render water mucilaginous; useful in gonorrhœa.

Dose.—2 máshes.

1393. Lippia nodiflora. *Vern.*—Gorukmundí.
(2124) Lahore.

SAPOTACEÆ.

1394. Mimusops kanki. *Vern.*—Khirní.
(2142) Lahore.
(1270) Jálandhar (khirní ka bíj).
(1888) Lahore.
The pulp of the fruit is edible; the flowers are aromatic; and the seeds yield oil. Considered by natives hot and moist. Applied to the eyes in ophthalmia; also used internally for leprosy and worms; also in thirst and delirium, and disorders of all secretions.

Dose.—2 máshas.

1395. Bassia latifolia. *Vern.*—Mahora? máhwa; mowa.
(2355) Kashmír.
It is hot and dry: useful in disorders of mucus and wind, and to cauterize wounds. The kernel of the fruit yields a white semi-solid oil, and a spirit is distilled from its flower, the petals of which contain much sugar.

LABIATÆ.

1396. Hyssopus officinalis. *Vern.*—Zúfah yábis.
(1885) Lahore.
(1467) Amritsar.
Used for coughs and asthma in infusion; also in toothache, uterine or vesical affections, and indurations of the liver or spleen. Leaves said to be stimulant, stomachic, emmenagogue and carminative; useful in hysteria and cholic; also as a poultice to bruises, especially of the eyes.

Dose.—10 máshas. Price, 10 annas a seer.

1397. Nepeta ciliaris. *Vern.*—Zúfa.
(1034) Delhi.
An aromatic stimulant.

1398. Prunella sp——. *Vern.*—Ustúkhúdús.
(1878) Lahore.
(2335-2369) Kashmír.
Used as a warm remedy for coughs and asthma; also in brain diseases, such as epilepsy; and also in toothache, cutaneous affections, dyspepsia and bilious disorders. A stimulant aromatic, used as a substitute for spike lavender, or for true lavender.

Dose.—6 máshas. Price, 4 annas a seer.

1399. Ajuga reptans. *Vern.*—Ján-i-ádam.
(2459) Kashmír.
Bitter, astringent, nearly inodorous; sometimes substituted for chinchona in the treatment of fevers.

1400. Ajuga sp——. *Vern.*—Makand bábri.
(1144) Ambálah.
Said to be two kinds "nar," or masculine, with red flowers; and "máda," or feminine, with white flowers—its virtues are supposed to be manifold. It is especially useful in ague. In reality it is an aromatic tonic.

1401. Mentha viridis. *Vern.*—Púdina.
(1098) Delhi.
(1241) Jálandhar.
(1374) Amritsar.
(1220A)
(1183) Ludhiana.
(1881-1882) Lahore (púdína kúhí, wild or hill mint).
(2407) Kashmír.
(2249) Dera Ghází Khán.
Pattiala.
It is considered hot and dry; prevents vomiting, and is used for indigestion and cholic. The cultivated plant is considered more powerful than the wild one. It contains much volatile oil. It is used in cholic and nausea, as an aromatic stimulant and carminative; also used with purgatives to prevent griping.

Dose.—6 máshas. Price, 4 rupees a seer.

1402. Mentha incana. *Vern.*—Múshk tarámusha.
(2350) Kashmír.
Used for rheumatic pains.

Dose.—6 máshas. Price, 4 annas a seer.

1403. Salvia Moorcroftiana. *Vern.*—Farásíún; tukhm-i-kanaucha.
(2451) Kashmír.
(2310) Kashmír.

1404. Salvia sp——. *Vern.*—Kanaucha.
(1493) Amritsar.
(1811) Lahore.
(2451) Kashmír.

1405. Ocymum sanctum. *Vern.*—Tulsi.
(1279) Jálandhar.
(1883) Lahore (bantulsi).
(1885) Lahore.

Used in fever and catarrh. It is a hot pungent remedy. Used for purifying the blood and indigestion; also in affections of the liver and leprosy. Considered by Hindús sacred to Vishnú. The leaves have a pleasant aromatic smell and taste, and are used as stomachics, and in the catarrhs of children (AINSLIE). The seeds are mucilaginous and are used in gonorrhœa.

Dose.—6 máshas.

1406. Ocymum sp— incerta. *Vern.*—Faringh mushk.

(1888) Lahore (seed).

Used to purify the blood and in indigestion. Said also to be emmenagogue and to relieve labor pains. Aromatic and diaphoretic.

Dose.—3 máshas. Price, 2½ annas a seer.

1407. Ocymum basilicum. *Vern.*—Niyázbo.

(950) Dera Ghází Khán (bábrí).

(1252) Jálandhar.

(1884) Lahore.

(1183) Dera Ghází Khán (káli tulsi or niyázbo).

Not much used by natives. The seeds steeped in water swell and form a pleasant jelly: useful as a diaphoretic and demulcent in catarrh, dysentery and diarrhœa; said also to be useful in fever. The juice of the leaves is used in catarrh.

1408. Ocymum pilosum. *Vern.*—Raihán.

(648) Gurgaon.

(1185) Ludhiana.

(1460) Amritsar.

(1886) Lahore.

(2205) Gújrat.

(2436-2418) Kashmír.

Seeds aromatic and carminative: used in cholic, diarrhœa and hœmorrhage, especially in bowel complants of children during dentition. Also to relieve pains after parturition.

Dose.—6 máshas. Price, 4 annas a seer.

1409. Origanum vulgare. *Vern.*—Marzanjosh.

(2354) Kashmír.

It contains a volatile oil, and is used as an aromatic stimulant and tonic in cholic, diarrhœa and hysteria; also as an application for chronic rheumatism and toothache; also against baldness, and in sprains and bruises. It is occasionally used as a dye, and is said to be emmenagogue.

1410. Lallemantia royleanum. *Vern.*—Tukhm bálangú.

(644) Gurgaon.

(1302) Jálandhar.

(1459) Amritsar.

Pattiala.

(2169) Rawalpindi.

(1879) Lahore.

A cold remedy: used principally for palpitation of the heart. Similar in action to ordinary mint.

Dose.—7 máshas. Price, 4 annas a seer.

1411. Melissa? or nepeta. Mountain balm. *Vern.*—Bililotan; baibarang katái; gandal; ban raihán.

(1880) Lahore.

(1584) Gurdaspúr.

(949) Dera Ghází Khán (gandal).

(1390) Amritsar (ban raihán).

(2337) Kashmír.

Said to have a peculiar attraction for cats. It is used in dyspepsia, flatulency and hysteria; also in fever and dysentery, and stomachic affections. A stimulant and aromatic tonic, used in affections of liver and heart; also in weakness of sight, and obstructions of mucous membrane.

1412. Nepeta ruderalis. *Vern.*—Bád-ranjboya.

(2386) Kashmír.

1413. Onosma echioides, and other species. *Vern.*—Ratanjot.

(1502) Amritsar.

(1598) Gurdaspúr.

(1876) Lahore.

(690) Gurgaon.

(2240) Dera Ghází Khán (yaralung, *so in original list*).

Applied externally with ghí to burns and piles (also given externally to purify the blood), and to cure weakness of sight.

Used principally for its coloring matter as a substitute for alkanet (*Anchusa tinctoria*). Plentiful in Kangra. Used to color liquids, particularly Rowland's Maccassar oil.

Dose.—6 máshas. Price, 4 annas a seer.

1414. Trichodesma indica. *Vern.*—Ratmandi; ratisurkh (Kashmír); nilakrái.

(1403) Amritsar.

(2288) Kashmír.

(2362) Kashmír (nílakrái).

Used for purifying the blood; also as a diuretic and a cure for snake bites.

Dose.—6 máshas. Price, 8 annas a seer.

1415. Onosma macrocephala. *Vern.*—Gáozabán; lisán-ul-ásár (Arabic).

(1067A-1067B) Delhi (flowers).

(1470) Amritsar.

(1575) Gurdaspúr.

(1903-1904) Lahore (flowers, gul gáozabán).

(2314) Kashmír.

Its rough leaves resemble a cow's tongue, hence the

name. It is used for palpitation and faintness. Said to be useful in rheumatism and leprosy. AINSLIE.

Gáozabán is often attributed to a species of Cacalia (*C. Kleinii*), a composite plant; but the flowers which accompanied two of the other specimens clearly belonged to a plant of the natural order *Boraginaceæ*.

Dose.—6 máshas. Price, 8 annas a seer. Price of flowers, Rs. 2-8 a seer.

SCROPHULARIACEÆ.

1416. Herpestes monniera. *Vern.*—Jal ním; shwet chamni (H).

(1896) Lahore.

Used for purifying the blood. The expressed juice mixed with petroleum is said to be useful in rheumatic pains. A diuretic. AINSLIE.

CONVOLVULACEÆ.

1417. Convolvulus arvensis. *Vern.*—Harinpádí (in Hindí medicine).

(2152) Lahore.

Juice said to be purgative.

1418. Convolvulus pentaphylla. *Vern.*—Shakarkandí.

(1015) Delhi.

(1867) Lahore.

Largely used for eating, and called sweet potatoe. Considered by natives hot, useful to strengthen the brain, and in special diseases.

1419. Convolvulus scammonia. *Vern.*—Mahmúdah (?) sakmúniá.

Convolvulus argenteus. Generally given in books for "samundar sokh." *See* **Salvia Plebeia.**

(1108) Delhi.

(1866) Lahore.

The pure scammony comes from Bombay; but a compound is made with senna leaves, gúr, &c. Used in obstinate constipation and coughs.

Dose.—2 máshas. Price, 7 rupees a seer.

Scammony is a gum resin, contains a peculiar resin, soluble in alcohol and ether. It acts as a diuretic, purgative, and is principally used in dropsy, in affection of the brain and to remove intestinal worms; also in dropsy and constipation.

Dose.—4 to 10 grains.

1420. Ipomœa turpethum. *Vern.*—Turbad; tirwí; nasút.

(1081) Delhi.

(1464) Amritsar.

(1864) Lahore.

It contains a purgative resin, resembling that of jalap. Used as a purgative in indigestion, but is very uncertain.

Dose.—9 máshas. Price, 2½ rupees a seer.

Used by hakíms in paralysis, gout and leprosy; also diseases of mucous membrane. The inner part of the root is preferred. It resembles jalap in its action, but must be used in a large dose.

1421. Pharbites nil, or Ipomœa cœrulea. *Vern.*—Ishpecha; káládána; hab-ul-níl.

(1448) Amritsar.

(1868) Lahore.

(2193) Gújrat.

(666) Gurgaon.

(1178) Ludhiana.

(1328) Jálandhar.

(1865) Lahore.

(1009A) Delhi.

(2410) Kashmir.

A valuable purgative: used as an efficient substitute for jalap in European and Native practice, especially in constipation, dropsy and intestinal worms; also in diseases of the brain.

Dose.—3 drachms. Price, 4 annas a seer.

1422. Evolvulus alsinoides. *Vern.*—Shank pushp (in Hindi medicine).

(2076) Lahore.

1423. Cuscuta reflexa. Dodder. *Vern.*—Aftímún; ákás bel; nirádhar (Gújrat list).

(1257) Jálandhar.

(1479) Amritsar.

(1561) Gurdaspúr (ákásbel).

(1870) Lahore.

(2376) Kashmír.

(1388) Amritsar.

(1184) Ludhiana (ákásbel).

(1781) Lahore.

(2200) Gújrat (nirádhar).

A warm remedy; purifies the blood, and is especially used in bilious diseases. It is said to be purgative, and used externally against the itch. It is used by hakíms in debility of stomach, melancholy, hypochondria, protracted fevers, retention of wind, and induration of the liver. It is said to produce thirst.

Dose.—3 máshas. Price, 10 seers to the rupee.

ACANTHACEÆ.

1424. Asteracantha longifolia, Barleria longifolia *Vern.*—Tálmakhána; phúlmakhána; gokantaka (?) gokshara (H.)

(763) Amritsar.

(659) Gurgaon.

(1895) Lahore.

Pattiala.

Used in special diseases. Considered cool and

moist. It strengthens the system, and acts as an astringent as a powder. A valuable mucilaginous diuretic in urinary diseases and dropsies, and cases of gravel. AINSLIE.

Dose.—4 máshas. Price, 8 annas a seer.

1425. Adhatoda vasica. *Vern.*—Bánsa. vásá; bahikat (?) H.

(940) Dera Ghází Khán.
(1450) Amritsar.
(1562) Gurdaspúr.
(2414) Kashmír (bhaikar?)
(2120) Lahore.
(1852) Lahore.

Leaves are purgative: flowers and roots are bitter and aromatic, also antispasmodic, and are used in asthma and fever. The wood is used for making charcoal for gunpowder. AINSLIE.

1426. Utangan.

(683) Gurgaon.

The botanical name of this is not known, but the plant clearly belongs to this order of plants. It is often, but erroneously, referred to *Urtica*.

Used for debility.

PLUMBAGINACEÆ.

1427. Plumbago Europea. *Vern.*—Chitra; chitah; shítraj.

(1335) Jálandhar.
(1395) Amritsar.
(1052) Pattiala.
(1195) Simla.
(2458) Kashmír.
(1155) Ambálah.
(1730) Lahore.
(2086) Lahore (chitra phal).
(2070) Lahore (buds, chítra pushp or múl).

Very useful as a blister, preferable to cantharides as as not affecting the urinary organs. Used by rubbing to a paste with flour: to be applied for half an hour. A powerful irritant, containing a neutral crystalline principle, plumbagine. It is principally used as a blister. Considered by natives dry and irritant; employed to cure skin diseases and to aid digestion; also mixed with oil to relieve rheumatism and paralysis.

PRIMULACEÆ.

1428. Anagallis cœrulea. *Vern.*—Giah surkh gul (Kashmír?); anásu kálá bhangra.

(2343) Kashmír.
(2379) Kashmír (anásu).
(1956) Lahore (kála bhangra).

Said to be poisonous to dogs, producing inflammation of the stomach: used in epilepsy, mania, and hydrophobia; also occasionally in dropsy. Formerly it was used in Europe in epilepsy, mania, hysteria, delirium, enlargment of the liver, spleen and dropsy, emaciation, stone, the plague, bites of serpents and mad animals, and numerous other diseases.

1429. Primula speciosa. *Vern.*—Bishkhapra.

(1871) Lahore.

A narcotic.

CORDIACEÆ.

1430. Cordia myxa. *Vern.*—Sapistán; lasúra.

(1177) Ludhiana.
(1228) Jálandhar.
(1862) Lahore.
(2201) Gújrat.
(693) Gurgaon.
(2226) Shahpúr.
(2347) Kashmír.
(2248) Dera Gházi Khán (sapistán).
(683) Gurgaon (ditto larger).

A demulcent fruit: is edible and laxative. The bark is a mild tonic used in fever. The leaves are useful as an application to ulcers, and in headache. Seeds are used for ringworm. The dried fruit is glutinous and expectorant, and useful in disease of the urethra. This is the Sebesten of old writers.

1431. Cordia angustifolia. *Vern.*—Gondi.

(1863) Lahore.

Bark used to make astringent gargles. Fruit eaten.

MONOCHLAMYDEÆ.

PLANTAGINACEÆ.

1432. Plantago isphagula. *Vern.*—Ispaghól or isabghol.

(635) Gurgaon (ísaf gúl).
(1111) Delhi.
(1166) Ludhiana.
Jálandhar.
(1380) Amritsar.
(1942) Lahore.
(2170) Rawalpindi.
(2194) Gújrat.
(2489) Jhind.
(2223) Shahpúr.
(2374) Kashmír.
(2489) Nabha.
(2246) Dera Ghází Khán.

It is much used in dysentery, and also piles and

special diseases; considered by some to be a perfect panacea, and that it may be given with safety in any disease.

A native of Persia. Small oval gray seeds, which swell up with water, forming a demulcent mucilage: used in catarrh and diarrhœa, especially to sheathe the mucous membrane, and are then given whole. It acts as a useful demulcent.

Dose.—9 máshas. Price, 2 annas a seer.

1433. Plantago amplexicaulis. *Vern.*—Gajpipalí.

(2088) Lahore.

Said to be an astringent: useful in intermittent fever, and as an application to the eyes in ophthalmia; also used against the bites of serpents, and in pulmonic complaints. AINSLIE.

1434. Plantago major. *Vern.*—Bártang.

(1474) Amritsar.

(1942) Lahore.

(2410) Kashmír.

Used as an astringent in dysentery, hœmoptysis, and internal bleeding; also as an application to the eyes in opthalmia. BIRDWOOD, refers *P. psyllium.* The Yunání synonym is "fasliyún," which looks like an adaption of *Psyllium.*

Dose.—6 máshas. Price, 5 annas a seer.

MYRSINACEÆ.

1435. Myrsine Africana. *Vern.*—Baibarang; baring (Arab); bimak Kábulí (?)

(1099) Delhi.

(1315) Jálandhar.

(1512) Amritsar.

(1026A) Pattiala.

(1872) Lahore.

(2385) Kashmir.

A warm remedy, used for dysmenorrhœa. Considered hot and dry by the natives; useful in dropsy, cholic and worms, and to remove costiveness.

It is said to be a powerful vermifuge; but occasionally produces vomiting in doses of 3 or 4 drachms: it is said to be largely used in Abyssinia, and to be greatly superior to the pomegranate root leaf. "Baibarang" (or "waiwarang") is often referred in books to *Embilia ribes.*

Dose.—3 máshas. Price, 2 annas a seer.

NYCTAGINEACEÆ.

1436. Mirabilis jalapa. *Vern.*—Gul'ábbás; a'básí.

(1168) Ludhiana.

(1767-68) Lahore.

The root is said to be equal to jalap: it is said that the root is a substitute for "chob chíní." Some consider it purgative; others not so. It is said that the powdered seeds are applied as white paint to the face in Japan. AINSLIE.

Dose.—1 toláh. Price, 8 annas a seer.

SANTALACEÆ.

1437. Santalum album. *Vern.*—Chandan; ajílah (?)

(1135) Delhi (chandan).

Considered by natives to be dry and cool, a tonic and antidote to poisons, also to allay thirst and clear the complexion.

POLYGONACEÆ.

1438. Rheum Moorcroftianum, and other species. *Vern.*—Rewand; rewand chíní; ribás (*Arabic.*)

(2039) DR. CLEGHORN.

(967) Delhi (rewand chini) rewásh (*Pers.*)

(957) Dera Ghází Khán.

(1206) Simla.

(1320-1520) Amritsar.

(1597) Gurdaspúr.

(1004A) Delhi.

(2281) Dera Ghází Khán.

(2287) Kashmir.

(5094) Pattiala.

(2039) Lahore (rewand; ribás).

(173) Kashmír.

(2038) Lahore.

1439. Rheum palmatum. *Vern.*—Chukri.

(1326) Jálandhar.

Used extensively by natives as a purgative and for purifying the blood; also applied to the eyes in opthalmia; also used in indurations of the liver, salivation and palpitation.

Dose.—6 máshas. Price, 4 annas a seer.

The stalks are extensively eaten in Kábul, where it is said that all the fruits are so hot, that without this remedy the people would become insane. The* stalks were also used as a cure for insanity.

Dose.—6 máshas.

Used largely by Europeans as a stomachic and astringent in small doses, and as a purgative in larger ones, especially in dyspepsia, and strumous affections.

Rhubarb contains a peculiar acid, called chrysophanic acid; also tannic acid, resin, and much oxalate of lime. It acts as an astringent tonic and purgative, and is principally used by Europeans in diarrhœa, dyspepsia, and diseases of children.

The following extract is from a letter from the

* *See* Transactions A. H. S., II., 245, as to rhubarb in Kábul.

Financial Commissioner to the Secretary to Government. Published in Supplement to the "Punjab Gazette," July 1862.

"As regards rhubarb, I may mention that it grows in abundance, and I understand to a large size in Barmor, and the valley through which the Rávi and its tributaries flow before reaching Dalhousie; which vallies, I believe, DR. CLEGHORN is now about to traverse—while a smaller variety deemed by the natives to be superior in quality to the foregoing grows in the crevices of the gneiss rocks, forming the peaks above Dharmsala. This fact I have brought to the notice of DR. CLEGHORN, who will probably have procured specimens before leaving that station."

Here follow extracts from DR. CLEGHORN'S diary:—

"10th May.—Encamped at the village of Kishang, crossed 5 a. m., with CAPTAIN HOUCHEN, by a short and steep ghát (summit about 13,000 feet) to the valley of Asrang, north latitude 31° 40′, east longitude 78° 20′, well known to sportsmen as the ibex ground and glacier, recorded in COLONEL MARKHAM'S book, 'Himalayan Sports,' being at the upper end of the valley, which does not appear to have been visited by scientific travellers, THOMSON and HOFFMEISTER having ascended the Werang ghát, a little to the eastward.

"Two feet of snow lay on the pass, which was not considered open, but a general thaw had commenced. After a laborious march of six hours we reached Asrang village, where the profusion of indigenous rhubarb at once attracted my attention. On both banks of the Teeti river, wherever the snow had disappeared, the old roots were throwing out fresh shoots of a delicate pink color. These protruded from crevices of rock (gneiss and mica slate), and indeed from under every solid stone and hedgerow, in such abundance, that this might be called the rhubarb valley. The common dock *(Rumex obtusifolius)* is not so conspicuous in the waste places of a highland glen as is the officinal rhubarb on the bare rocks in the valley of Asrang. It extends 5 or 6 miles down the valley, and ascends the slope to 500 feet above the river's bed; and I was assured by CAPTAIN HOUCHEN and the LAMA of Asrang, that it is equally abundant in the adjoining valley of Dingering.

"We enjoyed the leaf stalks served with sugar during our stay of two days, and a load was dispatched to Chini, where the ladies pronounced the rhubarb to be crisp, juicy and well-flavored. Any quantity of the leaves being procurable, their use was only limited by the amount of sugar in store.

"The LAMA attached to the village temple stated that the leaf stalks are not eaten (to any extent), being acid, "khata," and the roots are neither used nor exported. The large cordate (?) leaves are used to shade the eyes in crossing the pass, as a precaution against snow-blindness, and they are collected for littering yáks and goats.

"The roots vary much in size and shape. Some carefully selected and apparently of six or eight year's growth were compact and heavy, 4 to 6 ounces in weight; the largest procurable were picked out of the crevices of stone dykes, with a little soil and debris around them. When divided, the section presents the marbled appearance characteristic of commercial rhubarb. The bright yellow color, gritty taste, and peculiar aroma, were also satisfactory. In the autumn (September), when the stems die down, or very early in spring before the shoots sprout, the roots will be more compact and fit for carriage.

"I had an opportunity of testing the therapeutic action of the fresh root, and found it to resemble that of Russian rhubarb from Apothecary's Hall, 'which grows wild in Chinese Tartary, and extends to the south near Thibet" (PALLAS, Voyage, t. IV., p. 216), consequently at no great distance from upper Kunáwar. I have consulted the works of Himaláyan travellers,—HOOKER, THOMSON, GRIFFITHS, JACQUEMONT, HOFFMEISTER and JAMESON,—and find the occurrence of different species of the genus *Rheum* in various portions of the snowy range recorded by these authors. The excellence of the hill rhubarb as an article of diet is likewise corroborated by the MSS. reports of COLONEL LONGDEN and MAJOR THOMAS, who observed it in Kúlú and Pangi, respectively. But in ROYLE'S 'Illustration of the Botany of the Himályas,' the source of commercial rhubarb is fully discussed. When at Saharunpúr he made many efforts to trace its route, and as the information he collected is curious and valuable, I quote the result of his enquiries.

"The Chinese obtain the rhubarb produced in China Proper from that part of the province of Shensee—now called Kansu—situated between north latitude 35° and 40°. But the best, according to the missionaries, who say it is called Tai hoang, is in the province of Setchuen, from the mountains called Suechan—or of snow—which extend from north latitude 26° to 33°, and from about 100° to 105° of east longitude; that from the latter province, probably forms much of what is called China rhubarb. The missionaries met large quantities of it brought down in the months of October and November. That from Kansu may afford some of what is called Russian rhubarb: but both PALLAS and RHENIAN have ascertained that the greater portion, if not the whole of this, is obtained in April and May, from the clefts of rocks in high and arid mountains surrounding lake Kokonor.

"This would bring the rhubarb country within 95° of east longitude, and 35° of north latitude, that is into the heart of Thibet.

"As no naturalist has visited this part, and neither plants nor seeds have been obtained thence, it is as yet unknown what species yields this rhubarb.

"As it is improbable from the nature of the country that the best rhubarb is confined within very narrow limits, it becomes interesting to ascertain how near it approaches the British territories in India, in order to share in the trade or attempt the cultivation.

"Mr. MOORCROFT discovered rhubarb at Niti, and between Niti and Gotung, that is at elevations of 12,000 feet. If we turn our attention to the northern face of the Himálaya, which has so many features of a Tartarian climate, we find *R. spiciforme*, discovered by MR. INGLIS on the Werang pass, and at several places beyond. DR. GERARD describes the table-land of Tartary as covered with rhubarb, at elevations of 16,000 feet. Mr. MOORCROFT sent some rhubarb from near Ladákh, in north latitude 34° and east longitude 77½°, which for compactness of texture, color and properties, was as fine as any I have ever seen. But these are only the western boundaries of the elevated, cold and bleak regions, known under the names of Tartary, Mangolia, and Thibet, of which Kanáwar is essentially a part, participating in the same great physical features, climate and vegetation; this valley already possesses one, if not two species of rhubarb, and has the best growing in its immediate vicinity. There can therefore be no rational doubt about the successful cultivation of true rhubarb in territories within the British influence, as in Kanáwar, or the Bhoteah pergunnahs of Kumaon, and that with little more labor than placing the roots or seeds in favorable situations. The only difficulty will be to obtain specimens of the true rhubarb."*

"If my surmise be correct that the indigenous *Rheum*, widely diffused in the rocky valleys of Asrang and Dingering is one of the species furnishing the official rhubarb, or at least possesses valuable properties, cultivation is not required, but only a knowledge of the mode of dressing and preparing the roots, so as to make it merchantable. The following are the Himálayan species:—

1. *R. emodi* (Wall), Pindree glacier, &c.
2. *R. Webbianum* (Royle), Choor mountain.
3. *R. spiciforme* (Royle), Werang pass.
4. *R. Moorcroftianum* (Royle), Niti pass.

"The above four species yield part of the Himálayan rhubarb, according to PEREIRA (Mat. Med., Vol. II., page 485); the two last have denser and more yellow roots then the two first-mentioned, and I believe that the Asrang plant is one of them, but in the absence of stem, flower and fruit, the essential characters for identification were wanting.

"At present, Himálayan rhubarb makes its way sparingly to the plains of India through Almora and Bhotan (MADDEN. Asiatic Journ., 1848). Dr. WALLICH obtained specimens from the inhabitants of the Himálayas, who had strung them round the necks of their mules. In 1840, when China rhubarb was scarce and dear, 19 chests of Himálayan rhubarb were imported from Calcutta into England, but the samples do not appear to have been 'ordinary,' the color was dark-brown, the taste bitter, the odour feeble. It was exceedingly light and worm eaten.' This was the first shipment ever made of Himálayan rhubarb to England. Two chests sold at fourpence per ℔., the remainder at one penny per ℔.*

"Dr. ROYLE says that Himálayan rhubarb sells for only one-tenth of the price of the best rhubarb, resembling in quality the Russian, which is found in India. (Bot. Himálayan Mountains, page 316.)

"The quantity of rhubarb imported into Britain during six years, was as follows:—

1843	.. .. ..	268,766 ℔s.
1844	.. .. ..	206,015 „
1845	.. .. ..	323,416 „
1846	.. .. ..	427,694 „
1847	.. .. ..	305,736 „
1848	.. .. ..	116,005 „

"No later returns are available, but the above sufficiently indicates the importance of the trade, part of which may be expected to find an outlet through India, instead of passing north-west to Russia, or east-ward to China, before exportation to England.

"I.—From the researches of ROYLE and PEREIRA, it would appear that the varieties known as Russian and China rhubarb, are produced across the chain of Himálayan mountains, beginning at no greater distance (3 or 4 degrees of latitude) from the British territory. It is probable that the species affording them inhabit a widely extended area.

"II.—Although so important and familiar a drug, the source of the best varieties is not certainly ascertained. Specimens of flower, leaf and root, with exact information as to the locality, &c., are desiderata.

"III.—An inferior variety only of Himálayan rhubarb reaches the plains of Hindústán.

"IV.—The extension of hill roads, now in progress must have an important effect in promoting traffic in rhubarb, and other little known products along the frontier. If an annual fair were established at Chini, many northern traders would resort to it, and with

* "ROYLE's Illustrations of the Botany of the Himálayan Mountains." Page 314, *et seq.*

* (PEREIRA Mat., Med. Vol, II., page 492.)

the sanction of Government the quantity of rhubarb required for the medical stores might be purchased there instead of as now in a London warehouse, and and brought thence round the Cape to Calcutta.

"V.—I would suggest that carefully selected roots be gathered in Kanáwar, Kúlú, and Pangi (where rhubarb is known to grow) in autumn, for transmission to London, and subsequent valuation. Botanical specimens, with accurate date and locality should accompany the roots that the species may be identified.

1440. Polygonum sp———. *Vern.*—Bijband; kuwár kamin; humáz.

(1766) Lahore.
(1379) Amritsar.
(2235) Muzaffargurh (kuwár kamin).
(2206) Gújrat (tukhm humáz).
(2390) Kashmír (bekh humáz).

Used in spitting of blood and rheumatism. A substitute for rhurbarb in double doses.

Dose.—3 máshas. Price, 4 annas a seer.

1441. Rumex vesicatoria. *Vern.*—Chok or choka.

(1767) Lahore.

1442. Polygonum bistorta. *Vern.*—Anjabár.

(669) Gugaira.
(1765) Lahore.
(1466) Amritsar.
(1185) Ludhiana.
(2384) Kashmír.

It contains much tannic acid and acts as an astringent: used in dysentery, diarrhœa, and spitting of blood; also in fevers; also as an external application for ulcers and sore throat. Root very astringent: useful in sore throat and relaxed gums and ulcers; also in diarrhœa, hœmorrhage and intermittent fever. The young leaves are edible.

Dose.—7 mashas. Price, 4 annas a seer.

1443. Calligonum convolvulaceum. *Vern.*—Phog; tirní.

(1139) Sirsa.
(2000) Lahore (tirní).

1444. Polygonum fagopyrum. *Vern.*—Uglá; kaspat (and several other names. *See* under "Agricultural Produce.")

Pattiala.
Simla.

Seeds nutritive, contain much oil; said to be very fattening.

CHENOPODIACEÆ.

1445. Panderica pilosa. *Vern.*—Búi kalán. *See* No. **1458.**

(2002) Lahore.

1446. Suedia fruticosa. *Vern.*—Kharkhusa (or khaskhasa in Dera Ghází Khán list).

(937) Dera Ghází Khán (leaves).

1447. Anabasis multiflora. *Vern.*—Búi chotí.

(1956) Lahore.

1448. Chenopodium album. *Vern.*—Báthú, báthua (*Arabic*, kulf).

(1773) Lahore.

Used as food, also as medicine in special diseases; and to clean copper vessels, preparatory for tinning them. It is considered a laxative in diseases of the spleen, bile and worms.

1449. Spinacea oleracea. *Vern.*—Isfanák; pálak. Some pálak is *Beta bengalensis.*

(1772) Lahore (pálak).

Much used as a vegetable: considered to be cool and laxative: useful in difficulty of breathing, inflammation of the liver and jaundice.

BIGNONIACEÆ.

1450. Bignonia indica (?) *Vern.*—Syonak (Hindi).

(2048) Lahore.

Said to form a cooling drink in fever, and to be an antidote against poison.

DATISCACEÆ.

1451. Datisca cannabina. *Vern.*—Akalbír.

(2033) Lahore.

Used as a dye; also as an application for pain in the back.

AMARANTACEÆ.

1452. Achyranthes aspera. *Vern.*—Putkanda; chirchiri or phutkanda; apámargá (S.); agárá.

(952) Dera Ghází Khán.
(1517) Amritsar.
(1988) Lahore.
(2117) Lahore (apámargá).

Used for purifying the blood. Considered by natives pungent and laxative, useful in dropsy, piles, boils and eruptions of the skin. The stem is also used as a toothbrush. The seeds and leaves are said to act as emetics, and to be useful in hydrophobia and the bites of serpents.

Dose.—6 máshas. Price, 1 anna a seer.

1453. Amaranthus polygonus. *Vern.*—Chaulaí.

(1769) Lahore.

Considered by natives cool and dry, and to act as a diuretic and aperient; it promotes digestion and cures eruptions; it is also useful in special diseases. It is much used as a culinary vegetable.

1454. Amaranthus cruentus. *Vern.*—Táj-i-khurús; bustán afroz.

(1770) Lahore.

(2606) Kashmír (bustán afroz).

Used for purifying the blood and in piles, and as a diuretic in strangury.

1455. Amaranthus polygonoides. *Vern.*—Bantandúli.

(2092) Lahore.

1456. Celosia cristata. *Vern.*—Taj-i-khurús; kanjú.

(1770) Lahore.

(2268) Dera Ghází Khán (kanjú).

1457. Celosia argentea. *Vern.*—Salyára; chilchil; sil; sarpankha.

(1771) Lahore.

(692) Gurgaon (chilchil).

(1408) Amritsar (sarpankha).

(2270) Dera Ghází Khán (salyára).

(1021A) Delhi.

Used in special diseases.

Dose.—6 máshas. Price, 3 annas a seer.

1458. Ærua javanica. *Vern.*—Asl-ul-ghafrán; búí; makrela ?

(2001) Lahore (búí kálán).

(1725) Lahore (makrela).

MYRISTICACEÆ.

1459. Myristica officinalis. Nutmeg. *Vern.*—Jaiphal.

(1104) Delhi.

(1314) Jálandhar.

Is considered by natives a hot light remedy, allays vomiting, and acts as a vermifuge; remedies coughs. By European doctors it is used as a stimulant in cholic and inflammation; also applied externally in sprains. It resembles a small bird's egg. Externally it is brown and marked with furrows; internally it is dull pinkish-white, with dark brown veins.

Dose.—1 másha. Price, 2½ rupees a seer.

MACE.—Jauṅtarí.

(1096) Delhi.

Used as a stimulant in special diseases; also by hakíms in diseases of the eyes, stomach and spleen; and in herpetic eruptions. It produces stupor.

Dose.—2 máshas. Price, 2½ rupees a seer.

Both the kernel nutmeg and the aril mace contain fixed and volatile oils, and an acid called myristic acid, and act as aromatic stimulants. They are principally used in cholic and diarrhœa; also externally in chronic rheumatism, and an application to carious teeth. In very large doses, nutmeg is said to be narcotic.

The mace is used by hakíms to remove offensive breath, to correct the tone of the stomach or liver, and in consumption and flatulency.

Dose.—5 to 15 grains.

ELEAGNEÆ.

1460. Eleagnus orientalis. *Vern.*—Kankol mirich.

(698) Gurgaon.

(2020) Lahore.

(2019) Lahore (dáku phul).

(2340) Kashmír (gul-i-sanjad).

(1477) Amritsar.

Seeds used to adulterate black pepper; also as a stimulant in coughs. The ripe seeds are eaten as condiments: the oil from the seeds is used in bronchial affections

Dose.—2 máshas. Price, 2 rupees a seer.

Flowers (gul-i-sanjad) used in coughs and special diseases.

Dose.—2 máshas. Price, 5 rupees a seer.

LAURACEÆ.

1461. Cinnamomum albiflorum. The bark. *Vern.*—Taj.

(993) Delhi.

(1594) Gurdaspúr.

(1073A).

(1271) Jálandhar.

(1778) Lahore.

(2455) Kashmír.

(72A) Pattiala.

(1797) Lahore.

A warm dry remedy, used in coughs; also as an astringent in diarrhœa, and applied to abscesses; also used in cholic and indigestion.

Dose.—2 máshas. Price, 1 rupee a seer.

1462. Laurus cinnamomum. *Vern.*—Dár chíni; kirfa.

(1077) Delhi.

(1963) Lahore (kirfa).

It is close rolled quills, thin, of a light brown color; brittle, fracture splintery; odour pleasant; taste warm. It contains much essential oil, and a peculiar acid, called cinnamic acid, which resembles benzoic acid in its action; it also has a resin and much tannic acid. It acts as an aromatic stomachic and carminative; also

as an astringent; and is largely used in cholic and diarrhœa; also in low fever and vomiting; and the oil applied to teeth, removes tooth-ache, and as an addition to purgatives to prevent griping.

Dose.—10 to 30 grains.

1463. Cinnamomum albiflorum. Leaves. *Vern.*—Tamála; patra; tejpat; patraj.

(1109) Delhi.
(1271) Jálandhar.
(2440) Kashmír.
(1A) Pattiala.
(1778) Lahore (tamálpatta).

Considered by native hot and cardiac. Used in cholic and indigestion, and nausea.

The hakíms use cinnamon in debility of the stomach, enlargement of the spleen, affections of the nerves or heart, pains in the womb; also retention of of urine and catamenia; bites of serpents and poisoning by opium.

Dose.—6 máshas. Price, 3 annas a seer.

1464. Laurus camphora. Camphor. *Vern.*—Káfúr; mushk káfúr.

(1044) Delhi.
(1126) Ludhiana.
(1779) Lahore.

A white crystalline solid volatile oil, with a peculiar odour. Considered by natives cool. Principally used in cases of fever, headache and special diseases; also in disease of the eyes, corpulence, and poison; given both in powder and pills.

Dose.—1 ratí. Price, 2 rupees a seer.

A concrete volatile oil; extensively used in European practice as a stimulant, and diaphoretic, afterwards as a narcotic; it is used in typhus fever, inflammation of the brain, insanity, epilepsy, asthma and special diseases; also in gout, rheumatism, and to prevent bedsores.

Dose.—Grains 5 to 10.

1465. Tetranthera Roxburghii. *Vern.*—Meda chob; and the bark, meda sak.

(1587) Gurdaspúr.
(1951) Lahore.

Principally used for sprains and bruises in powder mixed with water: employed both externally and internally.

Berries yield oil which is used to make ointment and candles. The wood is aromatic, and the leaves contain a glutinous matter.

Dose.—6 máshas. Price, 4 annas a seer.

EUPHORBIACEÆ.

1466. Emblica officinalis. *(Emblic myrobalan).* *Vern.*—Amlá; bijí (?); dátu phal; aonla; shámí (Hindi).

(674) Gurgaon.
(971) Delhi.
(1355) Hushyarpúr.
(1148) Ambálah.
(1193) Simla.
(1366) Amritsar.
(1277) Jálandhar (aonla).
(971) Delhi.
(1678) Lahore.
(1585) Gurdaspúr.
(2182) Rawalpindi.
Pattiala.
Simla (leaves).
Kangra (leaves).
(2123) Lahore (shámí).

Considered by natives a cold and dry remedy: used in indigestion, diarrhœa and debility, and in piles; both in confections and cold infusion. Externally it is sometimes used to cleanse the hair.

The fresh fruits are acrid and purgative, and antiscorbutic; the dried simply astringent. It grows cultivated in the Punjab; the best are said to come from the Kohistán.

Dose.—1 tola. Price, 1½ annas a seer.

1467. Croton tiglium. Purging croton. *Vern.*—Jáyápál (Sanskrit); danti; jamal gotah; jaipál phal; hab-ul-mulúk.

(1094) Delhi.
(7289) Jálandhar.
(1674) Lahore.
(1519) Amritsar.
(2467) Kashmír.
(1676) Lahore.

Considered by natives hot and pungent: a violent purgative; useful in dropsy, worms, bilious affections: only safe for strong people. The hill people are said to eat 10 seeds at a time; the green embryo is supposed to be particularly poisonous. The seeds are oval, brown, slightly variegated; they contain a volatile oily acid, crotonic acid, and a fixed oil. Used internally as a purgative, and externally to rub over diseased joints.

By Europeans the oil is used in obstinate constipation, dropsy, apoplexy and mania; and as a powerful drastic. All parts contain powerful irritant cathartic poison: externally it is used to produce pustules, as a substitute for blisters.

Dose.—1 ratí, boiled with milk. Price, 12 annas a seer.

The seeds are the size of a sloe, and are considered one of the most drastic purgatives known. Ten or twenty seeds have been known to kill a horse, by producing the most violent diarrhœa. The usual way of making the oil is first to roast the seeds and then compress them. The color is brownish, or brownish-

yellow, soluble in fixed and volatile oils. So powerful is its action that a single drop of the oil applied to the tongue is considered sufficient to ensure the full results, especially in apoplexy, paralysis of the throat, or difficulty of breathing arising from those causes, even should the patient be insensible at the time. But this must be of the pure oil, for it is often adulterated with olive, castor, or purging nut oil. It is chiefly employed in incipient apoplexy, visceral obstruction, and occasionally in dropsy. The seeds mixed with honey and water are often applied to obstinate buboes in native practice.

The expressed oil of the seed is a good remedy, externally applied, in rheumatism and indolent tumours. RHEEDE says, that the leaves rubbed and soaked in water are also purgative, and when dried and powdered are a good application to snake bites. If the leaves are chewed they inflame the mouth and lips and cause them to swell, leaving a burning sensation. The mode of preparing the oil in Ceylon is by pulverising the seeds ; the powder is then put into bags, placed between sheets of iron, left to stand for a fortnight, and then filtered. Alcohol is then added to twice the weight of the residue. Much caution is requisite to avoid injury from the fumes which arise during the process. The wood, which is bitter tasted, is gently emetic, and powerfully sudorific.

1468. Buxus nepalensis. *Vern.*—Shamshád ; chikrí.

(1673) Lahore.

Wood diaphoretic ; leaves bitter, purgative and diaphoretic ; useful in rheumatism and syphilis : said to be poisonous to camels. From it a fœtid oil was formerly prepared.

1469. Ricinus communis. Castor Seed. *Vern.*—Arind ; bedanjir.

(1179) Ludhiana.

(1237) Jálandhar.

(1387-1515) Amritsar.

(1671) Lahore.

There are said to be three kinds—one with red pods, the second with yellow pods, and the third with pods without bristles. Much used as a warm purgative in many diseases, especially cholic, headache, dropsy, constipations and fever ; also antispasmodic diseases of the urinary bladder, and in rheumatism. The seeds fermented with milk are said to be useful for itch.

SEEDS.—Dandan dána.

(1088) Lahore.

The leaves are said to increase the secretion of milk and of the menses. The leaves are used at Hissar for the treatment of Guinea worm ; also applied to the breast of women to promote flow of milk.

OIL.—Arind ka tel.

(1363) Hushyarpúr.

The oil is used by Europeans as a laxative in constipation, cholic and dyspepsia.

Castor oil obtained by expression is less irritating than that obtained by digestion with alcohol. It contains stearic, palmitic, lauric and crotonic acids, united to glycerine ; also a yellow resin, which is the acrid principle. Four seeds have proved poisonous. Castor oil was made at Dinapore by first crushing the seeds, then sifting them and removing by hand any fragments of the husk, then the pulp is ground ; and again carefully picked, and afterwards compressed in 1 ℔. canvas bags; then warmed in the sun, and again compressed. Lastly, the oil is boiled to coagulate albumen, and then filtered.

1470. Euphorbia dracunculoides. *Vern.*—Bih rechní.

(1004A) Delhi.

(2003) Lahore.

Used to remove warts.

1471. Euphorbia antiquorum. *Vern.*—Farfiyún.

(2008) Lahore.

A purgative, used in pain in the loins. An acrid irritant ; used externally in rheumatism and in toothache, and internally it acts as a drastic purgative, and is used in diseases of the nervous system and dropsies ; also as an errhine in palsy, deafness and amaurosis.

Dose.—1½ mashas. Price, 8 rupees a seer.

1472. Euphorbia tiraculli. The juice. *Vern.*—Shír thohar.

(1263) Jálandhar.

A warm remedy : used in rheumatism, toothache and debility. The milk is said to cure affections of the spleen, and to act as a purgative in cholic ; also to be useful in special diseases. Externally it acts as a vesicatory. It is cathartic, emetic and antisyphilitic ; its action is very violent. It was formerly used in dropsical cases. It is said to be edible by goats.

Dose.—1 ratí.

1473. Euphorbia Royleana. *Vern.*—Shekar pitan.

(1023A) Delhi.

The purgative principle of the *Euphorbiaceæ* is principally found in the seeds, but also in the juice; it is an acrid resin. In cases of poisoning, lime juice is useful as an antidote. The difference in different plants depends on the amount of fixed oil with which the resin is combined. The active principle is most abundant in the embryo.

1474. Rottleria tinctoria. *Vern.*—Kamíla; rúlyá.

(1000) Delhi.

(1322) Jálandhar.

(1675-2357) Lahore.

(2309) Kashmír.

(1877) Lahore (rúlyá).

Used as a dye. It contains a yellow resin, *Rottlerine*, soluble in carbonate of soda and precipitated by acids. It acts as a purgative, and very sure anthelmentic in doses of from one to two drachms in cases of tape worm. It has been successful in 98 cases out of 100 of tape worm. *Rúlyá*, which is made from it, contains 78 per cent. of coloring matter: it consists of hairs obtained from the outer part of the capsules.

1475. Crozophora tinctoria. *Vern*—Sahádevi (Hindí); níl kantí ? níl ak rai.

(2118) Lahore.

(1426) Amritsar (níl kantí).

(2302) Kashmír (níl akrai).

1476. Carissa diffusa. *Vern.*—Mardak. (Hindí medicine).

(2117) Lahore.

1477. Putranjiva Roxburghii. *Vern.*—Jiyaputra.

(1297) Jálandhar.

(1672) Lahore.

(2074) Lahore (putranjivak).

Used as an ornament, not in medicine. The seeds or stones are strung on thread and worn as necklaces. This is considered to be a preservation against evil.

1478. Euphorbia lathyrus. *Vern.*—Sudáb. Delhi.

(1104A) Delhi.

Seeds purge and cause violent vomiting: used in dropsy; also to produce abortion. There is also a species of *Euphorbia* with narrow leaves: this root is said to be purgative if pulled up slantingly in one direction, and to be emetic if pulled up slanting in an opposite direction. Several other *Euphorbiaceous* plants are used—one called "hirbí," is said to be a very powerful poison. "Dodak" and "zaunchí" are names generically given to many *Euphorbias* with milky juice or sap.

ARISTOLOCHIACEÆ.

1479. Aristolochia longa. *Vern.*—Zaráwand kalán, or daráz, or tawil; isharmel (Hindí).

(1064) Delhi.

(1513) Amritsar.

(1930) Lahore.

The leaves are said to be useful against the bites of of poisonous snakes, especially the cobra. The root is bitter and emmenagogue, and is used in diseases of the womb; affections of the gums or ulcers; also in indigestion and bowel complaints of children. It is said to act as a tonic and febrifuge. This is the long "zaráwand," called "tawil daráz kalán," or (long, large).

1480. Aristolochia rotunda. *Vern.*—Zaráwand mundaraj or khurd; bekh za'frán; kanganmandi.

(1514) Amritsar.

(1929) Lahore.

(1655) Lahore (kanganmandi).

(2413) Kashmír (bekh za'frán).

Used in cough and special diseases. The root is hot and aromatic, supposed to be more powerful than the long species. It is used by natives in the treatment of itch, lice, and intestinal worms; also in leprosy and ulcers, and to promote secretion of urine. It is reputed an antidote for poisons. This is the small "zaráwand," called *khurd* or *mundaraj* (small, round).

Dose.—3 máshas. Price, 1 rupee a seer.

PIPERACÆ.

1481. Piper nigra. *Vern.*—Golmirich.

(1075) Delhi.

(1319) Jálandhar (siya mirich).

(1771) Lahore (kali mirich).

(1031A) Delhi (pipla múl, root ? probably root of peepul). *See* the next species.

(1775) Lahore.

(695) Gurgaon (*marked* "chob.")

Used for coughs, indigestion and piles.

Dose.—2 máshas. Price, 8 annas a seer.

The root is said to be bitter and dry, it is a stimulant tonic, is employed for coughs and indigestion; also fever.

Dose.—2 máshas. Price, 4 annas seer.

The fruit is a black wrinkled berry about the size of a pea, containing a grayish-white globular seed. An acrid stimulant, it contains an alcaloid, called piperine, and volatile oil: it is used in cases of fever, cholera and special diseases; also as a local application for piles, relaxed sore throat and some skin diseases: externally it is used as a rubefacient. A popular remedy for ague.

Dose.—5 to 20 grains.

1482. Piper longum or Chavica Roxburgii. *Vern.*—Pipal; maghz pipal or filfil daráz; dárfilfil or pipla múl (gaz pipal ?).

(1286) Jálandhar.

(1776) Lahore (dárfilfil).

(1007A) Delhi (filfil daráz).

(2047) Lahore.

(1565) Gurdaspúr (maghz pipal).

(1031) Delhi (pipla múl; maghz).

Used in indigestion, coughs and asthma.

Dose.—2 máshas. Price, 8 annas a seer.

The spikes are black and cylindrical, 2 inches long, covered with projections arranged spirally. An acrid stimulant and carminative. It has been used in intermittent fever, cholera and special diseases; also in beriberi. Considered by natives hot and dry: useful in wind, difficulty of breathing, to remove intestinal worms and to assist digestion; also as an aphrodisiac. (H).

Dose.—5 to 20 grains.

1483. Piper cubeba. Cubebs. *Vern.*—Kabáb chíní.

(968) Delhi.

(1284) Jálandhar.

(1774) Lahore.

The fruit resembles that of black pepper, but it has small stalks attached, hence it is called *Piper caudatus.* Used in gonorrhœa. It cures paralysis of the tongue, and cholic, and promotes digestion; it is said to dissolve calculi.

Dose.—3 máshas. Price, Rs. 1-8 a seer.

It contains volatile oil, resin and an alcaloid, called cubebine; and acts as an aromatic stimulant and diuretic. It is principally used by Europeans in the treatment of venereal disease, chronic bronchitis and piles.

Dose.—20 to 120 grains.

URTICACEÆ.

1484. Ficus carica, and F. caricoides. *Vern.*—Anjír.

(662) Gurgaon.

(969-1071) Delhi.

(1443) Amritsar.

(1670) Lahore.

(2371) Kashmír (small wild sort).

It consists of disk-shaped flattened pulpy receptacles, brown externally, containing internally numerous small hard seeds embedded in a soft pulpy mass. It contains chiefly sugar and mucilage. The dried fruit contains much sugar, and acts as a demulcent and laxative.

It is principally used as a diet in cases of constipation, and in diseases of the lungs, and urinary bladder; also as an application to boils and abscesses, instead of a poultice.

1485. Ficus religiosa. *Vern.*—Pípal.

(1668) Lahore.

Used in coughs and asthma. It is considered by natives cool and dry; the young leaves are said to be useful in affections of the skin and boils. The bark is said to be astringent, and is used in special diseases: also it promotes suppuration. The fruit is said to be laxative, and to promote digestion; and if eaten for 14 days, to remove asthma and produce fruitfulness in women.

Dose.—2 máshas.

1486. Ficus indica. *Vern.*—Bór; bar; bargat.

(1267) Jálandhar.

(1268) Jálandhar (shír, or milky juice of the tree).

The leaves are applied to bruises. The juice is milky and glutinous, and contains caoutchouc; it is occasionally used in toothache, and also applied to the cracked soles of the feet. The bark is supposed to be a tonic, and is used in diabetes.

1487. Ficus glomerata. *Vern.*—Gúlar; nirjiv dumba (Hindí).

(2050) Lahore.

Considered cool and moist by natives: used in diarrhœa and piles. Its bark is applied as an astringent to ulcers, and also to remove the poison of wounds made by a tiger or cat. The root is useful in dysentery. The fruits are edible but insipid, and are usually found to be full of insects. The fruit grows in bunches close round the branch or stem, hence the name *Glomerata.*

1488. Morus nigra. *Vern.*—Shahtút; tút.

(1669) Lahore.

(1242) Jálandhar.

The fruit consists of numerous small berries, each containing a single seed, united by their receptacle. The juice is sweet and of a deep red color. Used in sore throat. It contains sugar and tartaric acid, and acts as a pleasant refrigerent in fever. The fruit is used by hakims in sore throat, dyspepsia and melancholy. The bark is considered a purgative and vermifuge.

Dose.—6 máshas. Price, 1 rupee a seer.

1489. Cannabis sativa. *Vern.*—Bhang; kanub (*Arab.*)

(635) Gurgaon.

(1249) Jálandhar.

(1667) Lahore.

(1183) Dera Ghází Khán.

(1367) Amritsar.

(2391) Kashmír.

(1599) Gurdaspúr.

(1331) Jálandhar (charras).

(2321) Kashmír.

(40A) Pattiala (garda bhang).

(1039A) (ganjah).

(1132) Ludhiana (bhang).

(2247) Dera Ghází Khán.

Considered by natives hot and astringent: it promotes appetite, but intoxicates in large doses. Used in colds; but principally employed as an intoxicating drug.

There are several preparations. "Bhang" (the

leaves), "ganjah" (the flower tops), and "charras" (the resin exuding).

Price of charras, 6 rupees a seers.

CONIFERÆ, ENDOGENS, AND CRYPTOGAMS.

CONIFERÆ.

1490. Pinus longifolia. Turpentine. *Vern.*—Ganda biroza.

(974) Delhi.

Common turpentine. A mixture of oil of turpentine and resin. It acts as a stimulant diuretic, and is principally used in diseases of the urinary organs, chronic bronchitis, and hœmorrhages; also in rheumatism and fevers.

TAR.—Zift rúmí.

(2043) Lahore.

A stimulant diuretic; principally used in chronic bronchitis and skin diseases; also in phthisis; and as an application to ulcers. It is used to remedy itching of the skin in camels during the cold season. (H.)

1491. Pinus gerardiana. *Vern.*—Chilghoza.

(970) Delhi.

(1661) Lahore.

In special diseases, and for food in Kanawár, &c.

Price, 5 annas a seer.

1492. Cupressus sempervirens. *Vern.*—Sarv; haubér; májuphal; máín sabz; saro bij.

(976-986) Delhi.

(1939-1941) Lahore.

(1227) Jálandhar.

(170) Kangra.

Used as an aromatic stimulant in piles, and to purify the blood. Wood and fruit said to be astringent and anthelmintic. An astringent in diarrhœa and leucorrhœa.

Dose.—2 máshas.

1493. Juniperus communis. *Vern.*—Abhal; haubér; ratún dastí.

(939) Dera Ghází Khán (wild fruit).

(1528) Amritsar.

(1168) Dera Ismail Khán.

(2237) Dera Ghází Khán.

A warm dry remedy; used in dropsy and flatulency. It contains a large quantity of volatile oil, resembling oil of turpentine in its properties: it acts as a stimulant diuretic, and is principally used in dropsy, disease of the bladder and cholic.

Dose.—3 máshas. Price, 4 annas a seer.

1494. Taxus baccata. *Vern.*—Bráhmí.

(1664) Lahore.

(2397) Kashmír.

(1511) Amritsar (zarnab).

Used in epilepsy and indigestion. Leaves and berries poisonous to cattle. The leaves are said to be sedative like *digitalis*, but more manageable, and are used in epilepsy.

Dose.—3 máshas. Price, 4 annas a seer.

1495. Cupressus sempervirens. *Vern.*—Abhal; sarv kúhí.

(986) Lahore (sarv kúhí).

(1938-980) Delhi.

PENŒACEÆ.

1496. Penœa sarcocolla. *Vern.*—Anzarút; gosht khora.

(766) Amritsar.

(1981) Lahore.

A stimulant gum resin.

DIOSCOREACEÆ.

1497. Dioscorea deltoides. *Vern.*—Tarar; krish.

(2053) Lahore.

Roots are farinaceous and esculent.

ENDOGENS.

1498. Arum campanulatum. *Vern.*—Zamín khand; nágphanní-kand.

(1633) Lahore.

(2368) Kashmír.

(2068) Lahore (bansaran).

(2069) Lahore (nágphanní-khand).

A dry and warm remedy, used in coughs and asthma; also as an edible after cooking or pickling.

Dose.—6 mashas. Price, 3 annas a seer.

The roots contain a large quantity of farinaceous matter, mixed with acrid poisonous juice, which may be extracted by washing or heat. When fresh it acts as an acrid stimulant and expectorant; and is used in acute rheumatism.

ORCHIDACEÆ.

1499. Eulophia sp——. *Vern.*—Sá'lab misrí.

(1210) Simla.

(1475) Amritsar.

(1649) Lahore.

(2280) Kashmír.

(1651) Lahore (sá'lab kúhí).

Used in special diseases on account of its form. Said to be nutritive, restorative and aphrodisiac; but it is principally used on account of the Doctrine of

Signatures. For a further account of Saleb, *see* page 261.

Dose.—3 máshas. Price, 12 annas a seer.

ACORACEÆ.

1500. Acorus calamus. *Vern.*—Bach ; warch.

(1275-1327) Jálandhar.
(2363) Kashmír (warch).
(1476) Amritsar.
(1571) Gurdaspúr.
(1627) Lahore.
(1476) Pattiala.

Considered hot and bitter : useful in epilepsy and spine disease ; in cold, fever, coughs and rheumatism. It contains an aromatic bitter principle. It is a useful aromatic tonic. Used in fever, dyspepsia and cholic ; and also in chronic bronchitis and asthma ; also as an adjunct to purgatives.

Said to be brought from Kashmír. It is used in hœmorrhages and ulcerations of the intestines ; also in cholic and suppression of urine by hakíms. It is also used in England to give an aromatic flavor to gin, and certain kinds of beer, and in the preparation of aromatic vinegar.

Dose.—1 másha, or grains 10 to 20. Price, 2 annas a seer.

1501. Phœnix dactylifera. *Vern.*—Tamar ; chuhára ; khajúr ; khurma ; kujrán, kukyán.

KERNEL.—tukhm khurma ; gutli khajúr.

(1634)

DRIED DRUPES.—Khurma (Pers).

(1638).

DATES.—Khajúr ; kukyán ; khujiyán.

(1635) Lahore.

GUM.—Gond, or sher-i-darakht-i-khurma ; hukm chil.

SUGAR OF DATES.—Khurma.

(1637) Lahore.

A warm remedy, used in coughs and asthma. Dates are slightly purgative, and the gum is employed in diarrhœa and special diseases. The fruit is considered particularly useful in special diseases.

Dose.—7 tolas. Price, 2 annas a seer.

SMILACEÆ.

1502. Smilax china. *Vern.*—Chob chíní.

(1660) Lahore.

A tonic : used to purify the blood in skin diseases ; much employed by rich natives. It contains much starch, and acts as a demulcent and supposed aphrodisiac, and may be used as a substitute for sarsaparilla in venereal diseases.

Dose.—1 to 4 máshas. Price, 2½ rupees a seer.

MUSACEÆ.

1503. Musa paradisiaca. *Vern.*—Khela ; múz.

Lahore.

The leaves are useful to apply to inflamed or ulcerated skin, as in blisters. The fruit is nutritious and demulcent. The root and stem considered by natives tonics, and useful in disorders of the blood, and special diseases.

The fruit is sweet and nutritive, and is considered by some to be the original food of man in Paradise ; hence its specific name.

TYPHACEÆ.

1504. Typha angustifolia. *Vern.*—Dab ; luk.

(2342) Kashmír.

The young shoots are edible, and taste like asparagus. The pollen is combustible and resembles *Lycopodium.* The flowers are used in the treatment of burns.

COMMELYNACEÆ.

1505. Commelyna scapiflora. *Vern.*—Múslí siyah, or dakhaní.

(1295) Jálandhar.
(1498) Amritsar.
(1946) Lahore.

It is considered by natives to be hot and dry: useful in headache and giddiness ; also in fever, jaundice and deafness ; also as an antidote to poisons, and to cure the bite of snakes.

ZINZIBERACEÆ.

1506. Zinziber officinale. Fresh ginger root. *Vern.*—Adrak.

(1299) Jálandhar.
(1383) Amritsar.
(1647) Lahore.
(2367) Kashmír.
(40A) Sirmúr.
(2367) Kashmír.

DRIED GINGER ROOT.—Zangzabíl ; sonth.

(1316) Jálandhar.
(1643) Lahore.
(1024A) Pattiala.
(1507) Amritsar.

A yellowish white flattened rhizome, branched and knotted, with a short mealy fracture. It contains volatile oil and resinous matter.

A warm moist remedy, used to relieve coughs, asthma, piles, dysentery and diarrhœa, and in special

diseases and cholic as a cold infusion; also in pains in urinary bladder and in heartburn.

Dose.—6 máshas. Price, 3 annas a seer; or "south," 6 annas.

An aromatic stimulant, extensively used in European practice as an adjunct to other medicines, especially in cholic and rheumatism, also in relaxed sore throat: internally in dyspepsia, and as an adjunct to purgatives.

Dose.—10 to 20 grains.

AMAL BEDI.—A compound.

(1990) Lahore.

It contains much volatile oil and resin.

1507. Zinziber zerumbet. *Vern.*—Kachúr. The larger kind is called "nar kachúr."

(1484) Amritsar.

(1644) Lahore.

(1579) Gurdaspúr.

(2313) Kashmír.

(1A) Amritsar.

Considered by natives hot, and is used in coughs, asthma, and special diseases; also in leprosy, worms and skin diseases; also as a dye. It has an agreeable smell, and a hot bitter flavor.

Dose.—1 másha. Price, 3 annas a seer.

1508. Curcuma zedoaria. *Vern.*—Nirbisi; jadwár; jadwár khataí; ámba haldí.

(1472) Amritsar.

(1645) Lahore (nirbisi).

(2463) Kashmír.

(1953) Lahore (amba haldi).

Said to be hot and dry. Used for purifying the blood, and to cure disorder of wind and mucus, and in cholic; also to stop pain and vomiting; also as an external application to wounds.

It is a aromatic stimulant and carminative: it dyes yellow: it is employed in cholic, cramp of limbs and cardialgia.

Dose.—4 ratís. Price, 8 annas a seer.

1509. Curcuma longa. *Vern.*—Haldí; zard chob (Pers.)

(1296) Jálandhar.

(1487) Amritsar (haldí ágraí).

(1062A)

(1578) Gurdaspúr.

(1054) Lahore.

(1202A) Simla.

(62A) Pattiala.

(1485) Amritsar (zard chob chúán).

(1486) Amritsur (dar-haldí).

(1952) Lahore (ámba haldí).

In small cylindrical pieces; yellow externally, orange within; eaten as a food, and also used as coloring matter. Considered by natives hot and dry; useful in bruises, boils and swellings; also skin affections, and special diseases.

It contains much essential oil and starch, and acts as a stimulant and aromatic tonic; but is not often used internally, but principally as a test for alcaloids and boracic acid, which turns it brown; it is also used in dyspepsia, intermittent fever and dropsy; also as an application to ulcers. It is used both as a food and a dye stuff: the kinds best for the one purpose are less suited to the other.

Dose.—3 máshas. Price, 4 annas a seer.

N.B.—With reference to these species of *Curcuma*, *see* also page 299, &c.

1510. Alpina galanga. *Vern.*—Kúlinján; kúlanjána (Sanscrit).

(1642) Lahore.

Roots tuberous, covered with rings, brownish; inside dirty white; smell aromatic. It acts as a pungent and aromatic, and forms a substitute for ginger.

1511. Elettaria cardamomum. *Vern.*—Iláchí chota or khurd.

(1648) Lahore.

The fruit is a yellowish three-cornered capsule, much corrugated, it contains numerous dark red triangular seeds with a white interior. The seeds and fruit contain much volatile oil and coloring matter. They act as aromatic stimulants and carminatives.

By natives they are considered cool, aromatic and bitter, and are said to be useful in rheumatism and bilious complaints; also in flatulency and calculus. The native visitors sometimes present them on paying visits.

They are principally used in cholic, dyspepsia and fever in combination with other remedies, but are principally used either in food or with other medicines as adjuncts.

Dose.—5 to 20 grains.

1512. Amomum dealbatum or Cardamomum. *Vern.*—Iláchí barí or kalán.

(1110) Delhi.

(1647) Lahore.

Said to be more powerful than the smaller kind, but to resemble it in other respects. An agreeable aromatic stimulant.

1513. Hedychium spicatum. *Vern.*—Kápúr kachri; kachúr.

(1644-5096) Lahore.

Grows on the route to Kashmír. Is warm and aromatic, but is said only to be used by the natives in veterinary medicine.

1514. Costus speciosus. *Vern*—Kut talkh; kut karwá.

(1503) Amritsar.

(2025) Lahore.

Said by some to be the Putchuk root, though this is usually referred to the *Auklandia costus.*

It is an aromatic acrid tonic, which becomes bitter on keeping. Used by hakims as a tonic and aphrodisiac in debility of the nerves and stomach; also against intestinal worms, in suppression of the urine and menses. Externally it is employed to remove freckles and patches from the face.

IRIDACEÆ.

1515. Crocus sativus. Crow Saffron. *Vern.*—Kangammundi; kesar; zá'frán; kangan.

(1654) Lahore.

(2413) Kashmír (bark-i-zá'frán).

Considered by natives hot: useful in headache and vomiting, and to cure boils and eruptions of the skin. The stigmata are used: they consist of red filaments, broad and undivided at one end, but tripartile at the other. They contain volatile oil and a peculiar coloring matter, polychroite. Used in epilepsy, tetanus and special diseases; also as a dye, and in food. By the hakíms it is used in fever, melancholy, enlargement of the liver, and retention of urine.

By Europeans it was considered stimulant emmenagogue and diuretic, and was used in hooping cough, measles and chlorosis, but now it is seldom employed.

In moderate doses it stimulates the stomach, in larger quantities it excites the nervous system, having a specific influence on the mental faculties.

Dose.—Grains 10 to 20. Price, 8 annas a tolah.

1516. Iris florentina. *Vern.*—Bekh sosan; ersá (Kashmír).

(1639) Lahore.

(2413) Kashmír.

(2368) Kashmír (ersa).

The fresh root is said to be a drastic emmenagogue; when dried it is an aromatic sealogogue; principally used to form tooth-powder and hair-powder, and to make issue peas. Used for cough and rheumatism.

Dose.—3 máshas. Price, 8 annas a seer.

AMARYLLIDACÆ.

1517. Narcissus tazetta. *Vern.*—Nargis.

(1657) Lahore.

(2605) Kashmir.

Used for purifying the blood. Said to be an emetic in doses of 30 grains, and to be useful in hooping cough and epilepsy.

Dose.—1 másha.

MELANTHACEÆ.

1518. Colchicum illyricum. *Vern.*—Súrinján; talkh or shírín.

(1253) Jálandhar.

(1943) Lahore.

(1129) Ludhiana (talkh).

(2296) Kashmír.

Grows in Kashmír. Used in rheumatism and gout; the sweet kind is given internally, and the bitter used externally: seed also employed in gout.

By Europeans it is principally used in gout and rheumatism; also in affections of the heart and bladder.

Dose.—4 máshas. Price, Rs. 1½ a seer.

LILIACEÆ.

1519. Scilla indica. *Vern.*—Janglí piyáz; ishil?

(1128) Ludhiana.

Used as a diuretic: it is quite as bitter as the ordinary squill, which is employed as a powerful diuretic and expectorant; and in larger doses an emetic.

1520. Asphodelus fistulosus. *Vern.*—Bhaugár bij.

(1957) Lahore.

Said to be diuretic.

1521. Allium cepa. *Vern.*—Piyáz; gandhana (Pji.); basl (Arab.)

(1170) Ludhiana (seeds).

(1369) Amritsar (seeds).

(1650) Lahore (bij).

(33A) Pattiala.

Used as a food, and in special diseases. The bulbs contain an acrid volatile oil, and act as stimulants, diuretics and expectorants; they are occasionally used in fever, dropsy and calculi, catarrh and chronic bronchitis; also in cholic and scurvy; also externally as rubefacients, and when roasted as a poultice. It is considered by natives hot and pungent; useful in flatulency, and to prevent the approach of snakes or venomous reptiles.

Dose.—6 máshas. Price, 8 annas a seer.

1522. Allium sativum. *Vern.*—Lasam; thom (Arab.); gandhana?

(1169) Ludhiana.

(33A) Pattiala.

(2443) Kashmír (seeds).

Considered by natives hot and moist, aperient; useful to increase the knowledge and lengthen the hair! also in fever, coughs, piles, leprosy and special diseases. It resembles the onion in its active principle. It is used in hooping cough, fever, catarrh and convulsions of infants; also in dropsies and as an application for deafness. Used for food; also as a remedy for cholic and cholera. Externally its juice is applied to the ears for deafness and pain.

Dose.—1 másha. Price, 1 anna a seer.

1523. Convallaria. *Vern.*—Mitha dodiya; mithú; karimcha.

BULBS.—(Hills).

(2336) Kashmír (gul-i-sosan).

Kashmír (bekh zambak).

(2396) Kashmír (bekh sumbul).

(2062) Lahore (rishabha).

1524. Aloe indica. *Vern.*—Elwá; sibr; musabbar.

(1069A) Delhi.

(1309) Jálandhar (musabbir).

(1456) Amritsar.

(1656) Lahore (sibr).

Pattiala.

It has a powerful action on the uterus: is an emmenagogue and anthelmintic. It is considered cold and aperient, useful in affections of the spleen and liver, and fever; also in pain of the bowels. The pulp of the leaf is used in ophthalmia. Often used as a purgative.

Dose.—6 máshas. Price, 4 annas a seer.

A stimulating purgative, containing a neutral principle, aloesine; it acts especially on the lower intestines and womb. It is used in constipation, dyspepsia, jaundice, &c.

Dose.—grains 2 to 6.

1525. Aloe perfoliata. *Vern.*—Ban ustakí (Hindí medicine); ghíkwár; jívak pate.

(2133) Lahore.

(2148) Lahore (jívak pate).

The leaves are used by the natives externally in the treatment of rheumatism, abscess and ophthalmia, and internally in caries, and for coughs; also for diseases of the spleen and liver, and in fever.

1526. Asparagus racemosus. *Vern.*—Satáwar; bozandán; bozídán.

(651) Gurgaon.

(2072) Lahore (leaves).

(8A) Pattiala.

(1659) Lahore (bozandán).

(1009) Delhi (múslí safaid).

(1325) Jálandhar.

(1946) Lahore (múslí safaid).

(1499) Amritsar (múslí safaid).

Long cylindrical pieces of a tawny yellow semitransparent appearance, longitudinally obliquely indented. Taste sweet and mucilaginous. It acts as a diuretic. The roots often pass as "múslí safaid."

Used in special diseases. Considered sweet and cool; it increases the appetite, and removes pains of the bowels; also to prevent confluence of small-pox. Used as food.

1527. Polyanthes tuberosa. *Vern.*—Shabbo; zambak.

(1653) Lahore.

(2084) Lahore (rajni gandhi, Hindí).

(1652) Lahore (zambak).

Considered by natives hot and dry, diuretic and useful after labor; also in rheumatism. Roots emetic, and used as a dressing for burns.

1528. Asparagus racemosus. *Vern.*—Satáwar; shatawar-ká-patta.

Considered by natives cool and moist; useful in special diseases, and disorders of the wind, bile and thirst.

1529. Asparagus sarmentosus. *Vern*—Bozídan or bozandán.

(1971) Lahore.

MARANTACEÆ.

1530. Canna indica. Indian shot. *Vern.*—Hakík; karkota ka phal (in Hindí medicine).

(2065) Lahore.

The roots contain starch. The seeds are cordial and vulnerary; and are sometimes used for shot, and are strung for necklaces. Used as a diaphoretic and diuretic by natives in fevers and dropsy. AINSLIE. An allied species, *C. edulis*, yields the edibled root known as "*tous lesmois.*"

CYPERACEÆ.

1531. Cyperus longus, rotundus, and many other species. *Vern.*—Nágar mothí; sá'ad kofí; mothá; múthráñ.

(2449) Kashmír.

(668) Gurgaon (sád kofi).

(1185) Ludhiana.

(1628) Lahore (motha).

(32A) Pattiala.

(2348) Kashmír (múthráñ).

(1211) Simla.

(1631) Lahore (sád kofí).

(1419) Amritsar (múthra).

(1418) Amritsar (gharb gandhí).

(1627) Lahore (lunyáñ).

Used for coughs and fever. Useful in fever and indigestion; also in disorders of blood and bile.

It contains a bitter principle, and is tonic, diaphoretic, and diuretic; it is also aromatic, and is said to become stronger on keeping; it is said to be useful in cholera.

Dose.—3 máshas. Price, 3 annas a seer.

GRAMINEACEÆ.

1532. Panicum miliaceum. *Vern.*—Chínáñ; arzán.

(1619) Lahore.

(2293) Kashmír (rang ghás).

Used principally for food, especially after recovery from wounds.

1533. Pennisetum italicum. German millet. *Vern.*—Kangní.

(1007A) Simla.

(1621) Lahore.

Seeds small, delicate and wholesome. Used as a food. Considered by natives cool and dry, astringent and diuretic; used externally to relieve rheumatic pains. It is said to render beer more intoxicating.

1534. Cymbopogon aromaticus. *Vern.*—Khas; úsar; balam.

(1136) Sirsa.

(1456) Amritsar.

(1622) Lahore.

(2488) Jhínd.

(274A) Pattiala.

Considered by natives cool and astringent: useful in skin diseases, bilious affections, and special diseases. It is an aromatic stimulant, useful in fever, and to make tatties. The roots are dug up in March and April. Used as an aromatic in fever. Gives a fragrant oil.

Dose.—6 máshas. Price, 2 annas a seer.

1535. Andropogon iwarancusa. *Vern.*—Izkhar; khavi; gul-i-izkhar; lámjak (Hindí); ghatyárí (H.)

(1440) Amritsar.

(1625) Lahore.

(1626) Lahore (root).

(2488) Nabha.

(1625) Lahore.

(944) Dera Ghází Khán (katran, in original list).

(2153) Lahore (lámjak, Hindí).

Used for purifying the blood and in coughs; also in chronic rheumatism and cholera. Recommended as a valuable aromatic tonic in dyspepsia, especially of children. Used as a stimulant and diaphoretic, both by natives and Europeans in gout and rheumatism, and in fever.

Dose.—3 máshas. Price, 2 annas a seer.

1536. Oryza sativa. *Vern.*—Cháñwál; dhán (for varieties, *see* the Agricultural Class).

(1320) Jálandhar.

(1614) Lahore.

A useful food, containing 85 per cent. of starch. It acts as a demulcent and diuretic. It is occasionally used in diseases of the urinary organs and catarrh; also externally as an application to burns and scalds.

1537. Sorghum vulgare. *Vern.*—Joár ki ar; dhúra or zúra, &c. (Arabic).

(1615) Lahore.

Nutritious. Considered by natives cool. Useful in bilious affections and special diseases; less heating than "bájra."

1538. Agrostis cynosurioides. *Vern.*—Dháb ghás.

(1624) Lahore.

1539. Penicillaria spicata. *Vern.*—Bájra.

(1616) Lahore.

Supposed to be hot and dry, and to correct acidity in the stomach, but to be very heating, and therefore fitted for consumption in the winter months.

1540. Poa cynosurioides. *Vern.*—Dab; dúrva (Hindustání); kúsha (Sanscrit).

(1624) Lahore.

Used for food: also as a sacred offering among Hindús; and in affections of the urinary, bladder and calculus.

1541. Eleusyne corocana. *Vern.*—Mandwa; mandal or marwa.

Used as food, is one of the grains, which are lawful food for Hindús on fast days.

1542. Hordeum hexastichum. Barley. *Vern.*—Jau.

(1616) Lahore.

Used for food and for cases of sore throat. It contains gluten, starch and sugar. It acts as a laxative and demulcent, and is useful principally in fevers and inflammations; also in diseases of the bladder. When the husks are removed it is termed pearl barley.

1543. Saccharum officinarum. Raw Sugar. *Vern.*—Shakar surkh; khand.

(1623) Lahore.

(2022) Lahore (khand).

(927) Lahore.

Considered by natives heavy, tonic, and aperient. Useful in heat, delirium, disorders of bile and wind. A useful demulcent and article of food; chiefly used to add to other medicines to give them a pleasant flavor; but it has been recommended as an antidote in metallic poisoning, and in diarrhœa; and even in diabetes.

1544. Vermicelli. *Vern.*—Seviyáñ.

(1968) Lahore.

Used for purifying the blood.

1545. Gluten of wheat. *Vern.*—Nishásta.

(1620) Lahore.

(1010A) Pattiala.

Made by washing wheat flour. Used as an application for cutaneous diseases.

1546. Bambusa arundinacea. Bamboo (Silex from). *Vern.*—Tábashír; banslochan.

(4109) Lahore.

A siliceous concretion, found in the joints of the

bamboo; supposed to be cool and to remove thirst, fever and jaundice: it is in reality quite inert.

1547. Gardasiya.
(2033A) Lahore.
Dust from a flour mill which settles on the walls of the room or mill: it is used as a local application in headache.

1548. Flour. *Vern.*—Maida.
(2040) Lahore.
It is used as an emollient and demulcent, principally externally. It is applied to burns and scalds; also to erysipelatous surfaces; and occasionally it is employed as an antidote for cases of irritant mineral poisons, such as compounds of silver, mercury and iodine.

FILICES.

1549. Adiantum caudatum, venustum, and other species. *Vern.*—Par-i-siyáwashán: hansuráj.
(1345) Hushyarpúr.
(1196) Simla.
(1446) Amritsar.
(1612) Lahore.
(2224) Shahpúr (mubárak).
(2408) Kashmír.
(53A) Pattiala (hansráj).
(653) Gurgaon.
An astringent and aromatic; said to be emetic in large doses; also tonic and febrifuge. This is the fern which is used in making "capillaire" syrup.
Dose.—6 máshas. Price, 4 annas a seer.

1550. Polypodium. *Vern.*—Bisfaij.
(1480) Amritsar.
(1663) Lahore.
It is considered by natives that it purifies the blood in many diseases, especially of the skin, and acts as an emmenagogue. Root slightly purgative, saccharine and bitter.
Dose.—4 máshas. Price, 2 rupees a seer.

LICHENES.

1551. Parmelia chamchadalis. *Vern.*—Chailchalíra.
(1343) Hushyarpúr (chalíra).
(1447) Amritsar.
(1206) Simla.
(1610-1611) Lahore.
(2465) Kashmír.
Used for purifying the blood. Said to be a bitter tonic and astringent; used in intermittent fever and hœmorrhage. By hakíms it is used in dyspepsia, vomiting, pain in liver or womb, amenorrhœa, calculus, &c.
Dose.—3 máshas. Price, 2 annas a seer.

ALGÆ.

1552. Laminaria saccharina. *Vern.*—Gílarpatr.
(1607) Lahore.
Used in the cure of goitre: believed to be obtained from the Caspian sea. Is imported from Yarkand and *viá* Kashmír.
Dose.—1 másha. Price, 6 rupees a seer.
It contains much iodine, and acts as an alterative in scrofulous affections, and enlargement of the thyroid gland, goitre. If washed and hung up, a saccharine substance exudes.
Dose.—Grains 10 to 40.

DIATOMACEÆ.

1553. Diatomaceæ. *Vern.*—Hasan-i-Yusuf.
(1975) Lahore.
A minute siliceous shell of a triangular form, found floating on lakes and ponds in the hills of Kashmír, whence it is skimmed off and dried. Erroneously described by HONIGBERGER and others, as a seed.

FUNGI.

1554. Agaricus igneus. *Vern.*—Gháríkún.
(1608) Lahore.
Externally it is employed to stop bleeding from recent wounds; internally used as a purgative and anthelmintic.
It contains a peculiar resin: said to be useful in indurations of the liver and spleen, ague, epilepsy, and the bites of scorpions; also all bilious and mucous disorders. In reality it only acts mechanically.
Dose.—3 mashas. Price, 10 rupees a seer.

1555. Pad Bahera.
(1608) Lahore.
Is said to produce insensibility.

1556. Morchella esculenta (edulis). *Vern.*—Giri-chatra (Hindi); samárogh.
(2129) Lahore.
(1967) Lahore (samárogh).
Wholesome and agreeable: used as a sauce and as food.

1557. Morel. *Vern.*—Káná kachu; khat karwa (?)
(2024) Lahore.
(For an account of Morels, *see* p. 258).

JUGLANDACEÆ.

1558. Juglans regia. Walnut. *Vern.*—Akrot.
(1313) Jálandhar.
(1681) Lahore.

A warm and dry medicine: used in food and in special diseases, and rheumatism.

Dose.—3 máshas. Price, 8 annas a seer.

BARK.—Dandása.

(1682) Lahore.
(2474) Kashmír.
(2181) Rawalpindi (chál akhor).

It is said to be anthelmintic. The leaves are said to be astringent, tonic and to have almost a specific effect in curing strumous sores, in a decoction. Used as a dye; also as an astringent for piles. The bark of "rítha" (*Sapindus acuminatus*) is sometimes substituted. It is said to be emetic, and externally rubefacient. It has been used in scrofula and syphilis. It is also used as a dentrifice to clean and strengthen the teeth and gums. A twig of the tree is said to dispel flies. The juice from the roots is said to relieve pain from stone or gravel, toothache or gout.

Dose.—Price, 10 annas a seer.

MYRICACEÆ.

1559. Myrica sapida. *Vern.*—Kaiphal; kahi kahela?

(1018A) Delhi.
(1525) Amritsar.
(66A) Pattiala.
(5093) Simla.
(2031) Lahore.

A warm dry remedy: used in epilepsy and after confinements.

Dose.—6 máshas. Price, 3 annas a seer.

AMENTACEÆ.

1560. Salix babylonica. *Vern.*—Majnún.

(1665) Lahore.
(2061) Lahore (nambara in Hindí medicine).

The bark is quilted, dark-colored, fibrous and tough. It contains a neutral principle, called salicine, and tannic acid: it acts as an astringent and tonic, and is principally used in intermittent and other fevers. Some consider it nearly equal to cinchona. It is also said to be anthelmentic. (TROUSSEAU).

Dose.—Grains 20 to 30.

1561. Salix Ægyptiaca. *Vern.*—Bed mushk.

(1664) Lahore.
(2389) Kashmír.
(2157) Lahore.

A cold remedy: used for palpitation of the heart and insanity. The natives make a willow flower water, or "'ark bed mushk," to which they ascribe all sorts of virtues and cooling properties. It is much used in sherbet, and is a regular article of trade.

Price, 8 annas a seer.

1562. Populus alba. *Vern.*—Sufaida; baid (?)

(2035) Lahore.
(2036) Lahore.

It contains some salicine and acts as a tonic: used for purifying the blood and in skin diseases. Bark said to be useful in strangury.

Dose.—1 tolah.

1563. Quercus incana. Acorn of. *Vern.*—Balút; síl supárí.

(1377) Jálandhar (bán, the wood).
(1678) Lahore.
(2333) Kashmír (síla supári).

Used for indigestion, diarrhœa and asthma. Recommended for chronic diarrhœa in children, after burying in the earth to remove their bitter principle, then washing and grinding.

Dose.—3 máshas. Price, 4 annas a seer.

1564. Corylus avellana. Nut. *Vern.*—Findak; bindak.

(1679) Lahore.
(1001A) Delhi.
(2308) Kashmír.
(1006A) Delhi.
(2275) Dera Ghází Khán (kanjua).

Contains much oil. Used for coughs and special diseases.

Dose.—6 máshas. Price, 4 annas a seer.

1565. Betula tartarica. Birch. *Vern.*—Bhojpatr.

(1663) Lahore.

Used in sprains and bruises. The bark of this plant can easily be separated into thin leaves, like paper; it is largely used in Kashmír instead of paper, and also to line clothes. It is said to be useful in disorders of the bile and blood, also earache, and possession by evil spirits.

The inner bark is largely used in Kashmír, as it is said to prevent humidity. It is used to pack drugs, to stop the mouths of bottles, and envelope shawls.

1566. Balanophora? *Vern.*—Gochamúl.

(2344) Kashmír (in Vernacular Catalogue, "gargazmúl.")

ADDENDA TO THE DRUGS.

Menispermaceæ. The name "páth" is also applied to a **Cissampelos** (*see* page 325).

"Pálak," given as **Spinachia olerracea** is often **Beta bengalensis** (*see* **1449**, page 372).

"Pakhán bed" is often **Saxifraga ligulata** (*see* **1367**, page 362).

"Todri náfarmání" is often **Delphinium** (*see* page 327).

"Chimote" or "chirmati" is **Michelia champaca.**

"Detar dána," given as **Hedysarum** in the foregoing, should be **Uraria picta.**

Cuscuta reflexa. "Niradhar" of Gujrát, is supposed to be "nílá tár" ("the green thread"), (*see* **1423**, page 367).

Dolomœa macrocephala, is "dhúp."

Leucas cephalotes is "seselyús maldoda," or "chatra."

Centaurea moschata is "shah pasand" or "lál dána" (**1315**, page 355).

Verbena officinalis is "karaita" (*see* **1388**, page 364).

Aucklandia costus. Other names are—"kust shírín," "kust bahrí," "asinn" (*see* **1319**, page 356).

Pluchia is the "majni" of Dera Ghází Khán.

Cocos seychellarum, is the large daryai narel," of the shells of which fakírs make their bowls, called "chippí."

REPORT ON THE CHEMICAL AND PHARMACEUTICAL SUBSTANCES.

SECTION A. CLASS III.

DIVISION II.

THE JURY CONSISTED OF THE FOLLOWING GENTLEMEN:—

W. GREEN, ESQ., M.D., *Dep. Inspr. Genl.*
H. ELTON, ESQ., M.D., *Medical Store Keeper, Sealkot.*
J. SCRIVEN, ESQ., *Principal, Medical College, Lahore.*
A. M. DALLAS, ESQ., *Inspr. Genl. of Jails.*
J. PENNY, ESQ., M.D., *Offg. Civil Surgeon, Lahore.*
B. POWELL, ESQ., C.S., *Curator, Central Museum.*
J. BARTLEMY, ESQ., *Apothecary to the Citadel.*
RAM SING, *Drug Merchant, Lahore.*
MUHAMMED ISMAIL BASHI, *Manufacturer of Chemical Substances.*

REPORTER—DR. BROWN, *Professor of Chemistry, Medical College, Lahore.*

THIS division contains only the vegetable drugs, the medicaments derived from mineral and animal kingdoms are included in separate classes, and the mineral drugs have been considered in a separate report. The animal drugs, however, were too few in number to require a separate jury, and so have come under consideration of this. Including then, both mineral and animal drugs, the total number of drugs exhibited was 2039. These 2039 specimens may be divided into 247 drugs, derived from the mineral kingdom, which are described elsewhere; 1751 derived from the vegetable kingdom; and 41 drugs obtained from the animal kingdom; which two latter divisions form the subject of this report.

The following districts contributed specimens to the Exhibition:—

Districts.	Vegetable.	Animal.	Districts.	Vegetable.	Animal.
Gugaira, ...	68	1	Gugaira, ...	1	4
Hissar, ...	7	0	Jhang, ...	0	0
Rohtak, ...	0	0	Dera Ismail Khán,.. ..	57	0
Ambálah, ...	24	0	Dera Ghází Khán,.. ..	49	0
Ludhiana, ...	52	0	Peshawur, ...	0	0
Simla, ...	49	7	Kuhát, ...	0	0
Jálandhar, ...	126	4	Faridkhót, ...	0	0
Hushyarpúr,..	30	0	Delhi, ...	202	0
Kangra, ...	0	3	Sirsa, ...	5	0
Amritsar, ...	189	2	Hazára, ...	2	1
Lahore, ...	593	16	Kashmír, ...	203	3
Gujranwalla,..	6	0	Muzaffargarh, ...	7	0
Rawalpindi, ...	21	0	Jhínd, ...	6	0
Gujrát, ...	23	0	Nabha, ...	14	0
Jhilam, ...	8	0	Gurdaspúr,..	47	0
Shahpúr, ...	8	0	Pattiala, ...	84	0

No prize was allotted for the jury on vegetable drugs to distribute; but as many of the collections had been made with great care and diligence, the jury would strongly recommend that two Silver Medals, and seven Certificates of Honor be awarded to the various collectors of the drugs, in the manner mentioned below.

1st. That a Silver Medal and Certificate be awarded for the very extensive and admirably arranged collection of drugs from Lahore, which includes nearly one-third of the total number of drugs exhibited; together with a Certificate to PUNDIT RADA KISHN, for his Hill Drug Collection.

2nd. That a Silver Medal and Certificate be awarded also for the collection from Delhi, which has been most carefully labelled, and placed in suitable boxes; while at the same time it contains a large number of interesting specimens.

They would also recommend that Certificates of Honor be given for the collection of drugs made in the Hushyarpúr district, as well as for that from the Gújrat district, both of which, though consisting of only comparatively few specimens, have been selected with care, and are composed of remarkably good specimens, very distinctly labelled.

Also that a Certificate of Honor be given for each of the collections sent from the native states of Kashmír and of Pattiala, each of which is numerous, and contains several drugs of interest; and also one for the collection sent by DR. CLEGHORN, of carefully selected Hill Drugs.

Among these two thousand specimens, a large number are duplicates; others are only employed in native medicine for ailments which are better treated by moral means in European practice; but a considerable number remain which are really useful, and are employed in medicine, and extensively sold in the London market. Of these a list is subjoined, in which the current price, as extracted from the "Public Ledger," of February 17th, 1866, (the latest and best authority) is given. From this it may be seen that the following drugs might be advantageously sent from the Punjab to England:—Kino, gum acacia, til seed, poppy seed, gum tragacanth and scammony; while salep, euphorbium, and asphalt could be imported from England with advantage. But there are other drugs, the sale of which is not so great as to require a notice in the price current sent, which will be mentioned afterwards.

COMPARISON OF ENGLISH AND PUNJAB.

English name.	Indian name.	English price.	Indian price.	Remarks.
Asphalt, ..	Zift-i-rúmí, ..	Rs. 7 per cwt.	Rs. 5 per seer.	
Mimosa bark, chopped,..	Kíkar-ki-chál, ..	„ 135 per ton.	„ 12 per md.	
Brimstone, rough, ..	Gandak, ..	„ 80 „	„ 16 „	
„ roll, ..	„ ..	„ 100 „		
Alum, ..	Phitkarí, ..	„ 67-8 „	„ 7-11 „	
Antimony ore, ..	Surma, ..	„ 100 „	„ 15 „	
Arsenic, lump, ..	Sankhyá, ..	„ 8 per cwt.	„ 50 „	
Borax, E. I., ..	Sohaga, ..	„ 9 to 22 per cwt.	„ 16 „	
Camphor, ..	Kapúr, ..	„ 0-12 per lb.	„ 2 per seer.	
Copperas, green, ..	Hira kasís, ..	„ 27-8 per ton,	„ 5 per md.	
Corrosive sublimate, ..	Raskapúr, ..	„ 0-15 per lb.	„ 6 per seer.	
Minium, ..	Sandúr, ..	„ 10-8 per cwt.,	„ 16 per md.	
Sal ammoniac, ..	Naushadar, ..	„ 18 per cwt.,	„ 20 „	
Saltpetre, refined, ..	Shora kalmí, ..	„ 20 per cwt.,	„ 4 to 10 per md.	
Aniseed, ..	Badián khatai, ..	„ 65 „	„ 30 „	

English name.	Indian name.	English price.	Indian price.	Remarks.
Cassia fistula, ..	Ambaltás, ..	Rs. 10 to 17 per cwt.	„ 3 per maund.	
Castor oil seeds, ..	Arend-ka-bij, ..	„ 6-8 to 7 „	„ 3 „	
Colocynth, ..	Hanzil, ..	„ 0-4-6 to 0-8-0 p. lb.	„ 8 per seer.	
Croton seed, ..	Jumalgotá, ..	„ 35 to 40 per cwt.	„ 20 per md.	
Cubebs, ..	Kubáb chini, ..	„ 46 to 48 „	„ 50 „	
Cummin seed, ..	Zíra safaid, ..	„ 11 to 17-8 „	„ 10 „	
Fenugreek seed, ..	Methí, ..	„ 5-8 to 7-0 „	„ 2-8 „	
Galangal root, ..			„ 12 „	
Hellebore root, ..	Kali kútkí, ..	„ 13 „	„ 8 „	
Juniper berries, ..	Hauber, ..	„ 3 to 4-8 „	„ 8 „	
Munjith, ..	Mánjíth, ..			
Safflower, ..	Kussumbha, ..	Rs. 42 to 82-8 per cwt.		
Gum tragacanth, ..	Katira gond, ..	Rs. 90 to 125 per cwt.	„ 40 per md.	
Indigo, ..	Nil, ..	Rs. 1-4 to 3-12 per lb.	„ 12-8 per 5 seers.	
Lac, ..	Lakh, ..	Rs. 72 to 81 per cwt.	„ 60 per md.	
Pumice stone, ..		„ 55 to 90 „		
Sago, ..	Ságudána, ..	„ 8-8 to 10-8 „	„ 10 per md.	
Salt, ..	Nimak, ..	„ 1-12 to 2-12 p. ton		
Caraway seed, ..	Zíra, ..	„ 14 to 17 per cwt.	„ 10 per seer.	
Coriander, ..	Dhanya, ..	„ 5-0 to 7-0 „	„ 3 per md.	
Hemp, ..	Sann, ..	„ 18-8 to 20 p. bdle.	„ 5 per seer.	
Mustard, brown, ..	Rai, ..	„ 3-8 to 6 per barl.	„ 3 per md.	
„ white, ..	Sarsoñ, ..	„ 4-0 to 5 „	„ 4 „	
Poppy seed, ..	Khashkásh, ..	„ 25-8 per quarter.	„ 3-4 „	
Til, ..	Til, ..	„ 29-8 to 31.	„ 3 „	
Cotton, ..	Rui-ke-bij, ..	„ 75 to 77-8 p. ton	„ 2 „	
Cassia lignea, ..	Kirfa, ..	„ 42-8 to 47 p. cwt.	„ 40 „	
Cinnamon, ..	Darchini, ..	„ 0-8 to 0-14 p. lb.	„ 1 per seer.	
Ginger, ..	Sonth, ..	„ 22-8 per cwt.	„ 14 per md.	
Mace, ..	Jawantri, ..	„ 0-8 to 1-0 p. lb.	„ 3 per seer.	
Nutmeg, ..	Jaiphal, ..	„ 0-8 to 1-0 p. lb.	„ 2 „	
Pepper, ..	Gol mirich, ..	„ 0-3-6 per lb.	„ 0-7-0 „	
Cayenne pepper, ..	Lal mirich, ..	„ 0-6-6 to 0-13 p. lb.	„ 0-4-0 „	
Long pepper, ..	Pipla, ..	„ 15-8 per cwt.	„ 17 per md.	
Wax, ..	Mom, ..	„ 115 to 125 p. cwt.	„ 50 „	
Red sandal wood, ..	Rakhta chandan? ..	„ 57 per cwt.	„ 10 „	
Sappan wood, ..	Bakm, ..	„ 30 per cwt.	„ 6 „	
Musk, ..	Mushk, ..	„ 12 per ounce.	„ 25 p. chittack.	
Myrobalans, ..	Triphulla, ..	„ 93 to 121 per cwt.	„ 2-8 per md.	
Nuxvomica, ..	Kuchila, ..	„ 147 to 158 „	„ 10 „	
Orris root, ..	Bekh sosan, ..	„ 270 to 15 „	„ 14 „	
Pelitory root, ..	Akarkarha, ..	„ 32 „	„ 31 „	
Rhubarb, ..	Rewand, ..	„ 0-12-0 per lb.	„ 7 „	
Salep, ..	Salep misri, ..	„ 60 to 62-8 p. cwt.	„ 8 per seer.	
Scammony, ..	Sakmúniyá, ..	„ 16 per lb.	„ 5 „	
Senna, ..	Sauna makhi, ..	„ 0-2-0 to 0-4-0 p. lb.	„ 0-4-0 „	
Tamarinds, E. I., ..	Imlí, ..	„ 7-4 to 7-8 p. cwt.	„ 5 per md.	
Galls, ..	Majúphal, ..	„ 60 to 65 p. cwt.	„ 50 „	
Almonds, ..	Bádám, ..	„ 24 to 26 „	„ 12 „	
Figs, ..	Anjír, ..	„ 14 to 35 „	„ 16 „	
Raisins, ..	Kishmish, ..	„ 19 to 23-8 „	„ 8 „	
Dates, ..	Chuhhára, ..	„ 5-8 to 7 „	„ 10 „	
Gum arabic, ..	Kikar-ki-gond, ..	„ 30 to 34 „	„ 12 „	
„ assafœtida, ..	Hing, ..	„ 12-8 to 35 „	„ 14 „	
„ benzoin, ..	Lubán, ..	„ 230 to 320 „	„ 80 to 100 per md.	
„ dammar, ..	Dammar, ..	„ 17-8 to 27-8 „	„ 14 „	
„ euphorbium, ..	Farbiyúm, ..	„ 7-8 to 8-8 „	„ 5 per seer.	
„ gamboge, ..	'Usárá rewand, ..	„ 75 to 85 „	„ 80 per md.	
„ kino, ..	Kamarkas, ..	„ 150 to 200 „	„ 10 to 16 per md.	
„ mastic, ..	Mustagí, ..	„ 2-8 per lb.	„ 2-8 per seer.	
„ myrrh, ..	Bol, ..	„ 35 to 75 per cwt.	„ 100 per md.	
„ sundrach, ..	Sundras, ..	„ 42-8 to 51 „	„ 20 to 40 „	

NOTE.—It is to be remembered that these prices change much from time to time: the list serves to show the general quotation of price.

Although the price of a large number of these drugs is too close to that at which they are procurable in England, to allow of their being exported with advantage from the Punjab, yet there can be no doubt but that it would be much cheaper for Government to purchase them for the Mofussil Medical Depôts on the spot, instead of buying them in England and conveying them from England to Calcutta, and from Calcutta to the Punjab. This remark would only apply to such drugs as are imported from England, such as kino, gum acacia, &c. But there is a large number of medicines, of which many are usually obtained from the bazar; and a list is therefore subjoined of those which are at present more or less frequently used in medicine; also of those which were formerly so employed, and those which require a further trial, as their medicinal properties are not yet fully ascertained, or at least generally known among practitioners in India. The mark (B.P.) has been added to designate those medicines which have been admitted into the British Pharmacopœia recently published.

Drugs used now.	Drugs formerly used.	Drugs recommended for trial.
Aconitum ferox.	Nigella sativa.	Thalictrum foliosum.
„ heterophyllum.	Pæonea corallina.	„ momeera.
Cocculus cordifolius.	Malva rotundifolia.	Argemone mexicana.
Papaver somniferum (B. P.)	Althæa rosea.	Bombax heptaphyllum.
Illicium anisatum (B. P.)	Viola serpens.	Vateria indica.
Sinapis alba (B. P.)	Oxalis corniculata.	Peganum harmala.
„ nigra (B. P.)	Rhus coriaria.	Ruta angustifolia.
Shorea robusta.	Helicteres isora.	Celastrus paniculatus.
Cochlospermum gossypium.	Trigonella fœnumgræcum.	Albagi maurorum.
Sapindus acuminatus.	Abrus precitorius.	Xanthoxylon hostile.
Berberis lycium.	Mucuna pruritis.	Barringtonia acutangula.
Linum usitatisimum (B. P.)	Cæsalpinea sappan.	Tamarix gallica.
Garcinia sp——. (B. P.)	Pterocarpus draco.	Hyperanthera pterygosperma.
Ægle marmelos (B. P.)	Terminalia chebula.	Nima quassoides.
Citrus aurantium (B. P.)	„ citrina.	Zyzyphus jujuba.
„ limonium (B. P.)	„ bellerica.	Semecarpus anacardium.
Melia azadirachta.	Apium involucratum.	Pistacia integrifolia.
Amyris commiphora.	Ptychotis ajwain.	Prinsepia utilis.
Ruta angustifolia.		Lawsonia inermis.
Pistacia lentiscus (B. P.)	Emblica officinalis.	Ptychotis ajwain.
Butea frondosa.	Pistacia vera.	Carum gracile.
Indigofera tinctoria (B. P.)	Myrtus communis.	Rubia mungista.
Acacia vera (B. P.)		Morina Wallichiana.
Glycyrrhiza glabra (B. P.)	Opoponax cheironum.	Randia dumetorum.
Acacia catechu (B. P.)	Lactuca.	Valeriana sp——.
Cathartocarpus fistula (B. P.)	Chicorium intybus.	Serratula anthelmintica.
Cassia elongata (B. P.)	Centaurea behmen.	Fraxinus floribundus (manna).
Tamarindus indica (B. P.)	Strychnos Ignatii.	Picrorhiza kurrooa.
Guilandina bonducella.	Wrightea antidysenterica.	Nerium odorum.
Amygdalus communis (B. P.)	Hollarrhena antidysenterica.	Nicandra indica.
Prunus domestica (B. P.)	Solanum nigrum.	Symplocos racemosa.
Rosa centifolia (B. P.)	Hyssopus officinalis.	Ocymum sanctum.
Cydonia vulgaris.		„ pilosum.
Caryophyllus aromaticus (B. P.)	Ipomea turpethum.	„ basilicum.
Punica granatum (B. P.)	Plumbago zeylanica.	Plumbago ispagula.
Narthex assafœtida (B. P.)	Polygonum bistorta.	Embelia ripes.
Cuminum cyminum.	Datisca cannabina.	Myrica sapida.
Anisum vulgare.	Emblica officinalis.	Andropogon aromaticum.
Pimpinella anisum.	Euphorbia officinalis.	Vitex negundo.
Daucus carota.	Aristolochia longa.	Gmelina arborea.
Anethum sowa.	„ rotunda.	Cuscuta reflex.
Fœniculum vulgare (B. P.)	Santalum alba.	Cordia myxa.
	Cupressus sempervirens.	Myrsine africana.

Drugs used now.	Drugs formerly used.	Drugs recommended for trial.
Coriandum sativum (B. P.)	Pœnœa sarcocolla.	Eleagnus orientalis.
Narthex assafœtida (B. P.)	Eulophia sp.——— ?	Myrica sapida.
Dorema ammoniaca (B. P.)	Smilax china.	Parmelia chamchadulis.
Opoponax chironum.	Curcuma zerumbet.	Commelyna scapiflora.
Citrullus colocynthus (B. P.)	Curcuma zedoaria.	Hedychium spicatum.
Valeriana jatamansi.	Alpinia galanga.	Costus speciosus.
Lactuca sativa.	Iris florentina.	Cymbopogon aromaticum.
Carthamus tinctoria.	Colchicum illerium.	Andropogon iwarancusa.
Matricaria chamomilla.	Cyperus longus.	
Anthemis pyrethum.	Adiantum capillus veneris.	
Artemisia indica.	Polypodium.	
Styrax benzoin (B. P.)	Agaricus igneus.	
Strychnos nuxvomica (B. P.)	Allium sativum.	
Strychnos potatorum.		
Calotropis procera.		
„ gigantea.		
Hemidesmus indica (B. P.)		
Ophelia chirayta (B. P.)		
Gentian.		
Solanum tuberosum.		
Physalis somnifera.		
Capsicum fastigiatum (B. P.)		
Datura fastuosa.		
„ metel.		
Hyoscyamus nigra (B. P.)		
Solanum dulcamara (B. P.)		
Sesamum orientale.		
Mentha viridis (B P.)		
Onosma echioides.		
Convolvolus scammonia (B. P.)		
Ipomea cœrulea.		
Plantago ispagula.		
Rheum sp——— ? (B. P.)		
Myristica officinalis (B. P.)		
Camphora officinum (B. P.)		
Laurus cassia.		
„ cinnamomum (B. P.)		
Cinnamomum albiflorum.		
Croton tiglium (B. P.)		
Ricinus communis (B. P.)		
Rottleria tinctoria (B. P.)		
Piper nigrum (B. P.)		
Piper longum.		
Piper cubeba (B. P.)		
Morus nigra (B. P.)		
Cannabis indica (B. P.)		
Salix.		
Quercus galls (B. P.)		
Pinus sp——— (turpentine.)		
Acorus calamus.		
Phœnix dactilyfera.		
Zinziber officinale (B. P.)		
Curcuma longa (B. P.)		
Elettaria cardamomum (B. P.)		
Crocus sativus (B. P.)		
Allium cepa.		
Scilla sp——— (B. P.)		
Aloe indica.		
Oryza sativa.		
Hordeum hexastichon (B. P.)		
Saccharum officinarum (B. P.)		

It has been thought desirable also to append a list of all the vegetable drugs ordered in the new Pharmacopœia, with the substitutes which can be obtained in the Punjab for

each of these; and it will be remarked how few vegetable drugs there are for which substitutes cannot readily be obtained in the Indian bazars.

The following list is subjoined of all the vegetable drugs admitted into the British Pharmacopœia, with the substances which may be used with good effect in India as substitutes, and the scientific name of the latter.

Drugs ordered in the British Pharmacopœia.	Native name of substitute.	Scientific name of substitute.
Acacia,	Gond kíkar,	Acacia arabica.
	Gond-i-phuláhi,	Acacia modesta.
	Gond-i-zárdalú,	Prunus domestica.
Aconiti radix, Aconitum,	Mítha bish,	Aconitum ferox.
Aloe barbadensis, ,, socotrina,	Musabbir,	Aloe indica.
Ammoniacum,	'Ushk,	Dorema ammoniacum.
Amygdala,	Bádám,	Amygdalis communis.
Amylum,	Nishásta,	Amylum.
Anethum,	Sowa,	Anethum sowa.
Anthemis,	Bábúnah,	Matricaria chamomilla.
Armoracia,	Sohánjna,	Hyperanthera pterygosperma.
Arnica,		
Assafœtida,	Híng,	Narthex assafœtida.
Aurantii cortex,	Náringí,	Citrus aurantium.
Balsamum canadense,	Ganda baroza,	Pinus longifolia (turpentine).
,, peruvianum, ,, tolulanum,	Lubán,	Styrax benzoin.
Belladonna, ,, radix,	Dhatúra,	Datura fastinosa.
Benzoinum,	Lubán,	Styrax benzoin.
Bucco,	Barg morad,	Myrtus communis.
Cajeputi, oleum,		
Calumba,	Gilo,	Tinosperma cordifolia.
Cambogia,	Usárah rewánd,	Garcinia sp——.
Camphora,	Kafúr,	Laurus camphora.
Cannabis indica,	Ganjah,	Cannabis indica.
Capsicum,	Lál mirich,	Capsicum fastigiatum.
Cardamomum,	Iláchí,	Elettaria cardamomum.
Carum,	Zíra síah,	Carum gracile.
Caryophyllum,	Laung,	Caryophyllus aromaticus.
Cascarilla,	Warch,	Acorus calamus.
Cassia,	Ambaltás,	Cassia fistula.
Catechu nigrum, ,, pallidum,	Kat,	Acacia catechu.
Cetraria,	Chalchalíra,	Parmelia chamchadalis.
Chiretta,	Ispagol, chiraita,	Plantago ispagula, Ophelia cheretta.
Cinchona sp——.	Atís,	Aconitum heterophyllum.
	Rasaut,	Berberis lycium.
Cinnamomum,	Dár chini,	Cinnamomum officinarum.
Cocculus,	Kákmáchi,	
Colchici cortex et semen,	Surinján,	Colchicum illyricum.
Colocynthus,	Hanzil,	Cucumis colycynthus.
Conium (and fructus),	Dhatura,	Datura fastuosa.
Copaiba,	Kabab chíní,	Piper cubeba.
Coriandrum,	Dhaniya,	Coriandrum sativum.
Cotton,	Rúi,	Gossypium herbaceum.
Crocus,	Kesar,	Crocus sativus.
Cubeba,	Kabáb chíni,	Piper cubeba.
Cusparia,	Kath karanjwa,	Guilandina bonducella.
Cusso,	Kamíla,	Rottlera tinctoria.
Digitalis,		
Dulcamara,	Rúba bárík,	Solanum dulcamara.
Elaterium,	Jamálgota,	Croton tiglium.

Drugs ordered in the British Pharmacopœia.	Native name of substitute.	Scientific name of substitute.
Elemi,	Anzarút,	Pœnea sarcocolla.
Ergota,		
Ficus,	Anjír,	Ficus carica.
Filix,	Bisfaij,	Polypodium.
	Kamila,	Rottlera tinctoria.
Fœniculum,	Sonf,	Fœniculum vulgare.
Galbanum,	Jawáshir,	Opoponax chironum.
Galla,	Májuphal,	Gall of quercus.
	Máin choti and bari,	Gall of tamarix.
Gentian,	Gentian, pakan bed,	Gentian.
	Kaur,	Picrorrhiza kurrooa.
Glycyrrhiza,	Mulatthí,	Abrus or Glycyrrhiza.
Granati radix,	Anár ka jar,	Punica granatum.
Guaiaci lignum et resina,		
Hæmatoxylum,	Saki,	Bark of Cassia fistula.
Hemidesmus,	Anantamúl,	Hemidesmus indica.
Hordeum,	Jau,	Hordeum hexastichon.
Hyoscyamus,	Khorásání ajwain,	Hyoscyamus niger.
Indigo,	Nil,	Indigofera tinctorium.
Ipecacuanha,	Madár,	Calotropis procera.
Jalapa,	Káládána,	Pharbitis nil.
Kamcela,	Kamila,	Rottlera tinctoria.
Kino,	Gond dák,	Butea frondosa.
Krameria,	Saki,	Bark of Cassia fistula.
Lauro-cerasus,		
Limoni cortex,	Khatta,	Citrus limonum.
Lini semen et farina,	Alsí,	Linum usitatissimum.
Litmus,		
Lobelia,	Támákú,	Nicotiana tabacum.
Manna,	Sherkhist,	Manna of Fraxinus.
	Turanjbín,	„ Alhagi maurorum.
	Shakkar taghár,	„ Calotropis procera.
Masticha,	Rúmi mustagi,	Pistacia lentiscus.
Matica,		
Mezereum,	Sannarkat, &c.,	Daphne sp.——
Mori succus,	Tút,	Morus indica.
Myristica,	Jaiphal,	Myristica officinalis.
Myrrha,	Bol,	Balsamodendron myrrha.
Opium,	Afim,	Opium.
Papaver,	Post,	Papaver somniferum.
Pareira,		
Pimento,*		
Piper,	Gol mirich,	Piper longum.
Pix burgundica,	Ganda baroza,	Pinus longifolia (resin).
Pix liquida,	Zift-i-rúmí,	Pix.
Podophyllum,		
Prunus,	Alúcha,	Prunus domestica.
Pterocarpus,	Rakta chandan,	Pterocarpus santalinus.
Quassia,	Atís,	Aconitum heterophyllum.
	Chiraita,	Ophelia chiretta.
	Farangí,	Nima quassoides.
Quercus,	Dandása,	Bark of Juglans regia.
Resina,	Rál safaid,	Shorea robusta.
Rheum,	Rewand,	Rheum sp———.
Rhœas,	Kusumbha,	Carthamus tinctoria.
Rosa canina,	Gul khand,	Conserve of roses.
„ centifolia,	Guláb,	Rosa.
„ gallica,	Guláb surk,	„
Sabadilla,		
Sabina,		
Saccharum,	Khand,	Saccharum.
Sambucus,	Motia,	Jasminum zambac.
Santonica,	Afsantín,	Artemisia indica.

* Obtainable from the South of India.

Drugs ordered in the British Pharmacopœia.	Native name of substitute.	Scientific name of substitute.
Sarsa, ..	Anantamúl, ..	Hemidesmus indica.
Sassafras, ..		
Scammonii radix, ..	Sakmúníyá, ..	Convolvulus scammonium.
Scammonium, ..		
Scilla, ..	Ishill, ..	Scilla indica.
Scoparius, ..		
Senega, ..		
Senna Alexandrina, Indica, ..	Sanna makkí, ..	Cassia elongata.
Serpentaria, ..	Muthra, motha, ..	Cyperus sp——.
Sinapis, ..	Sarson, ..	Brassica campestris.
	Rai, ..	„ juncea.
Stramonii, folia et semen, ..	Dhatúra, ..	Datura alba.
Styrax, ..	Lubán, ..	Styrax benzoin.
Tabacum, ..	Tamákú, ..	Nicotiana tabacum.
Tamarind, ..	Imlí, ..	Tamarindus indica.
Taraxacum, ..	Pili jarí, ..	Thalictrum foliosum.
Theriaca, ..	Khand, ..	Saccharum.
Thus americanus, ..		
Turmeric, ..	Haldí, ..	Curcuma longa.
Ulmus, ..		
Uva ursi. ..		
Uvæ, ..	Kishmish, ..	Vitis vinifera.
Valerian, ..	Dálá, ..	Valeriana sp——.
	Bálchir, ..	Nardostachys jatamansi.
Zingiber, ..	Sońth, ..	Zingiber officinale.

From the above lists it will be observed how large a proportion of the vegetable drugs of the present Pharmacopœia are either themselves obtainable in the Punjab, or have efficient substitutes there obtainable; and, therefore, that small dispensaries might be able to obtain most of their vegetable drugs from sources in India, without putting Government to a large expense for importing drugs; and this especially applies to the Punjab more than the most parts of India, since the expense of the land carriage is much greater. It must be remembered, however, that it is only the simple remedies which are so obtainable, and that many of the preparations of these cannot be always advantageously made at small dispensaries ; while some of the most important preparations cannot be made at all at present, such as sulphate of quinine, but it is hoped that the plant which produces it will soon be entirely naturalized in the hills.

As an appendix to the above Report, it may be added that a small compilation on the action and uses of the medicines usually found in the Punjab bazars would be of great service in instructing officers attached to dispensaries (especially those who have recently arrived in this part of India), in the medicaments of which they can avail themselves, and the uses to which such may be applied. Such a compilation would describe all the useful drugs ordinarily available in the Punjab, the mode of recognising them, their action and uses, and the best mode of preparing them for administration.

T. E. B. BROWN, M.D.,

Reporter to the Jury.

CLASS IV.—SUBSTANCES USED IN MANUFACTURES.

SUB-CLASS (A). GUMS AND RESINS.

This class may be subdivided into—

I. True gums, known by their solubility in water.

II. *Gum resins*, not soluble in water, but soluble in alcohol.

III. *Resins*, inflammable substances, soluble in alcohol, ether and volatile oils. They exude from the trees, and become solid by combination with the oxygen of the air.* Useful in arts for varnishes. This includes also—Balsams and oleo-resins.

Balsams are semi-solid or liquid exudations from plants, and containing either benzoic acid or an essential oil, or both. The liquid balsams, of which the most used are the balsam of copaiba, &c., are unrepresented in the collection. There are two solid balsams included—Benjamin or styrax, and dragon's blood (*Pterocarpus draco*), (*not Dracæna draco*).

Oleo-resins are resins combined with volatile oils: on distillation the oil passes over, leaving a resin behind. The class is represented by turpentine, or ganda biroza, "chil ka gond."

IV. Elastic gums.

Scarcely represented in the Punjab, save by the *Calotropis procera* (*Hamiltonii*), whose juice will yield a substitute for gutta percha. The Madras Presidency illustrated this section in the Exhibition of 1864, by a specimen of *Euphorbia* gutta percha (*Euphorbia antiquorum*), and a sample of "yercum" gutta (*Calotropis*). Since then attempts have been made in the Punjab to produce these substances, and with some degree of success.

I should mention that gums are generically called in the Punjab "gond" or "chír" (Punjabí), or "simagh" (Arabic). Gum resins being all imported, and chiefly used in medicine, are called by their specific names only. Resins are generally called "rál."

* URE's "Chemical Dictionary of the Arts."

I. GUMS.

1567.—Gum arabic (*Acacia arabica*). *Vern.*—Gond kíkar; simagh 'arabi; bábul gond.

This gum is produced from several species of *Acacia*—the *A. arabica*, the *A. farnesiana* (Vachellia), and the *A. vera* (the scented blossomed small *Acacia*, distinguished from the others by not having moniliform but roughly cylindrical pods). The "gond phulahí," or gum from *Acacia modesta*, is very similar.

The samples of gum exhibited vary from pure white to pale yellow, amber color, and reddish amber. The sample of *A. arabica*, &c., sent from the Madras Presidency is darker than any we have ever seen in the Punjab.

In Jálandhar a good *Acacia* yields a seer of gum annually for the first three years or so, but the tree dries up as it grows older. Specimens of "kíkar" or "babúl" gum, were sent from—

(4049) Delhi.
(4057) Hissar.
(4052) Gurgaon.
(4059) Sirsa.

"Bábul" and "kíkar" gums were distinguished in this latter district—the 1st being from the *A. arabica*; the 2nd, from the "choti kíkar" (*Vachellia*

farnesiana); it is gathered in March and April, and is exported from Sirsa eastward: it is much used for sweetmeats.

(4058) Rohtak (bábul).
(4061) Ambálah.
(4065) Jálandhar.
(4071) Kangra.
(4093) Amritsar.
(4113) Lahore.
(4138) Gujrát.
(4148) Jhilam.
(4150) Shahpúr.
(4154) Gugaira.
(4157) Muzaffargarh (bábul dá chír).

Price, $2\frac{3}{4}$ seers per rupee (*V. farnesiana* or *A. vera*); also "kikar dá" at 2 seers per rupee.

(4170) Peshawur, from Kábul and Hindustán, and the Punjab; sells at Rs. 10 a maund.
(4172) Kapúrthalla.
(4174) Pattiala.
(4167) Dera Ghází Khán.

1568.—[4070]. "Pipalla gond" (*botanic name?*)

A red gum. Said to be obtained from the "kikar," and used in making red ink. Exhibited from Kangra but not produced there.

Gum arabic is often mixed with other gums, as "siris," "phúllá," &c.; it varies in color, some being pure and other being colored red, from the astringent principle of the tree bark. The different colored gums are separately prescribed by native doctors—the red is said to be a remedy for coughs. Arabic gum is given to women at childbirth as a tonic. (As to color and degree of solubility, *see* Report of Jury). Some of the globules of gum are extremely friable, others not: this is said to be due to rain having fallen on them after exudation, and their subsequently drying in the sun.

1569.—Gond-i-phúláh (*Acacia modesta*).

This tree is abundant in Hushyarpúr.

(4078) Hushyarpúr.
(4122) Lahore.
(4139) Gujrát.
(4146) Jhilam.
(4150) Shahpúr.

1570.—Gond bhímbrí.

Is a gum yielded by the same tree as the last, but coming (it is said) from "Bhímbar," where these trees are abundant.

(4217) Lahore.
(4039) Amritsar.

1571.—Gond-i-siris, or chír sirín dá (*A. sirissa*).

A coarse gum, used for adulterating gum-arabic, and used under the name of "lera," in the art of printing calicoes with gold and silver leaf patterns. It is not soluble completely, like "gond 'arabi," but forms a stiff kind of jelly. Specimens appear from—

(4061) Ambálah.
(4068) Kangra.
(4152) Shahpúr.
(4160) Muzaffargarh.

Price, 2 seers per rupee.

1572.—[4050]. Khair-ka-gond (*Acacia catechu*). Gurgaon, Mewatti hills, and elsewhere.

A sample is also sent from Hissar, into which district it is imported from the neighbouring territory, and sells at Rs. 2 per maund.

A whitish gum, like arabic, which exudes from the bark when wounded: must not be confused with the "kath," or extract of catechu. (*See* Tanning Substances).

1573.—[4067]. Gond-i-dhao. Kangra district.

A transparent soluble whitish gum of *Conocarpus latifolius.* This is found in several places in the hills, and yields a useful gum. A specimen was sent down for Nimar, on the Beás valley, where it is abundant.

1574.—[4066]. Kaimal, or kahmal gond. Kangra and Haripúr.

Used in calico printing. A dirty concrete, granular, brownish-black substance, that hardly looks like a gum—quite unlike the following. *Query*, perhaps this is a *gall* or excrescence from the bark of *Bombax heptaphyllum?*

1575.—[4077]. Kaimal gond (*Odina wodier*), from Hushyarpúr.

This has been evidently dissolved and then allowed to evaporate and coagulate again. The gum is in the form of a thick cylinder, with a bore or hollow in the middle; it is a pale stone colored gum, quite soluble, and unlike any other sample, it is described on the box lid as used to mix with chunam and whitewash.

1576.—[4143]. Kamala, or kemal, or kambal gum (*Odina wodier*). Jhilam.

The same as the above (brownish color and soluble, but not completely). Used in medicine for preparing plaisters.

1577.—[4090]. Gond-i-alúcha. Plum-tree gum (*Prunus alucha*), from Amritsar bazar. Local Committee.

1578.—[4123]. Gond-i-shaft-álú. Apricot tree gum (*Armeniaca vulgaris*). Lahore bazar.

An amber colored and soluble gum.

1579.—[4049]. Gond-i-darakht-i-ámb. Mango gum. Delhi.

A white gum, chiefly used medicinally. This is not the bitter strong tasting resin that is found in the fruit skin. This gum appears principally to be used down-country; the only sample in the 1864 Exhibition was from Delhi.

1580.—[4156]. Jhand ka gond. Jhand tree gum (*Prosopis spicigera*). Muzaffargarh. Local Committee.

Also (4166) Dera Gházi Khán. A sample of the same, called "kunda" in the local list.

1581.—[4165]. Chir-odheli, or vadhál. Dera Ghází Khán. (Hills).

In a vernacular account it is noted as coming from the "Bárkhán ki pahár." Obtained from the tamarisk (*T. furas or dioica*); said to be called "pinjwa" in other parts.

This occurs in nodules, highly friable, of a granular texture; the nodules appear opaque or a pale yellow; but the little grains of which the nodule consist are individually transparent, the centre of each nodule is more transparent and of a red color: its taste is very peculiar, of a bitter combined with sweet, like a mixture of liquorice, aloes, and sugar: it is quite soluble in water.

1582.—[4090]. Katíra gond (*Cochlospermum gossypium*). Amritsar bazar. Local Committee.

A sample is sent from Lahore (4126).

This is a semi-transparent white gum, in striated pieces, very much twisted and contorted; is a substitute for tragacanth. The tree occurs in the hills, is common in Garhwál and Kumaon, and grows also in Hindustán.

"Katira gond (*Cochlospermum gossypium, False tragacanth*). Samples are sent from Lahore and Amritsar. It grows at Hardwar, on the Sub-Himaláyan Hills, on the Hill Frontier of the N. W. Provinces, whence it is imported into the Punjab; it grows also in Southern India. It occurs in pieces, white, striated and twisted, and curled: it is used in the trade of shoe-making.

1583.—Jingan gum. Simla hills.

The white gum of *Odina wodier*, in stalactic white semi-transparent pieces, with little bits of bark intermingled. A sample of *Odina wodier* gum was sent from Madras, and is very dark colored and quite unlike this, being the dark variety.

1584.—"Sohájna" (sohanjna), gum of the *Hyperanthera moringa* (*Moringa pterygosperma*).

This is sometimes called "mochras;" in fact just as often as the sembal gum (*Bombax heptaphyllum*) is in the bazars. This gum varies in color from a red to a semi-opaque pink to almost white. The pink kinds are the most esteemed. It is used medicinally. Exhibited from—

(4046) Delhi.

(4069) Kangra district.

(4144) Jhilam. A very light colored sample, consisting of whitish pieces intermixed with pink.

(4155) Gugaira.

(4158) Muzaffargarh. Sells at 2¼ seers per rupee.

(4164) Dera Ghází Khán.

(4151) Shahpúr.

(4176) Patriala.

1585.—Mochras or sembal gond (*Bombax heptaphyllum*).

(4076) Hushyarpúr.

(4145) Jhilam.

(4092) Amritsar.

(4120) Lahore.

This is a very highly astringent dark colored gum, much used in medicine by natives.

1586.—Mochras or phúl súpyárí (*Areca catechu*).

(4056) This is a specimen of that kind of *Mocharas*, which *looks* not unlike sembal gum, but is in reality not a gum at all, but a brown astringent gall blister, that is found on the *Areca catechu* palm. A sample is sent, called "saigata gond," from Gurgaon (4050). In my own collection there is a sample of this gum, which I got at Sealkot, called "mochras or phúl súpyárí" (flower of the areca), which last name, though "flower" is incorrect for a gall, yet indicates the origin. This is imported from Hindustán and Bengal, &c.; so that "mochras" has three meanings—1st, sohájna gum; 2nd, sembal gum; 3rd, areca galls.

1587.—Dhák gum or kamarkas (*Butea frondosa*).

A strong astringent gum, which exudes in red tears from the dhák tree. This might be produced in considerable abundance. There are in the Cis-Sutlej States (Kurnál and Thanesar) whole tracts of jungle

covered with the *Butea*. The dhák gum is supposed in native medicine to be highly tonic and aphrodisiac, hence its name "kamarkas;" it is a valuable tanning agent; it is used in European medicine, also being called "East Indian kino."

When fresh it is of a beautiful transparent red, in small sized fragments or grains; but when kept, it becomes opaque and darker in color.

It dissolves perfectly in water and partially in spirit. As a coloring matter it is strong and durable, but cannot easily be applied to tanning purposes. For an account of the properties of the gum, *see* Journ. Agri.-Hort. Soc. Bengal, Vol. V., p. 114, and VIII., p. 24, 1852; *see* also Journ. Roy. As. Soc., Lond., VII., p. 145. It is used in medicine as a powerful astringent, administered in the form of tincture and powder. Some specimens of this kino when analysed yielded 73½ per cent. of tannin. The natives in the North Western Provinces employ it for precipitating their indigo, and in tanning; but in England it is objected to on account of the discoloration it imparts to leather.

Samples were sent from—

(4047) Delhi.
(4053) Gurgaon.
(4091) Amritsar.
(4140) Gujrát.
(4147) Jhilam.
(4153) Shahpúr.
(4176) Pattiala.

As the earlier volumes of the Agri.-Hort. Society's Journal are now scarce, I extract some of the most useful passages from the paper in Vol. VIII. of the Transactions.

Tanning properties of the gum of the "dhák."— "With the view of making the information on the above subject more complete, we reprint from the 'Journal of the Royal Asiatic Society of Great Britain and Ireland,' the following paper, by PROFESSOR SOLLY, entitled, 'Experiments on the Dhák Gond, a natural exudation of the *Butea frondosa.*'

"This substance, which, although it differs in some particulars from the kino, which is found in the shops, yet as it agrees in its most important properties with what has so long been described under that name, it is most convenient to call it 'butea kino.'

"It is of a brilliant ruby red color, and transparent, and very brittle. It consists principally of small round tears, and other fragments, which from their form appear to have been detached from the lesser branches of the tree. When it has been kept for some time, it becomes opaque and dark colored; this, however, may be prevented, according to DR. ROXBURGH, by preserving it in well-closed bottles.

"When exposed to heat, the 'butea kino,' swells up, emits fumes which are partially inflammable, and then ignites; if after that it is removed from the source of heat, it continues to glow like tinder, until nearly wholly consumed, a very small portion of a white ash only remaining. Ten grains of the kino, carefully selected as to purity, were ignited in a covered platinum vessel, and retained at a red heat until all the carbonaceous matters were burnt; there then remained 0·45 grains of white ash, a very small portion of which was soluble in acids with effervescence, the remainder consisted principally of silica and alumina. The specimens of 'butea kino,' were far from being in a state of purity, being mingled with small fragments of wood, bark, and also with earthy impurities: these were evidently derived from the mode of collection, which most probably consisted in gathering from the ground under the trees the fragments of the natural exudations which had fallen from them.

"It swells and slowly dissolves in the mouth, having a pure, strong, astringent taste, like the finer kinds of catechu. It has no smell. In cold water it swells, and slowly imparts to it its fine red color; after some time, only the outer portions of the kino remain, which by exposure to the air had become dark-colored and almost insoluble in water, whilst the whole of the interior and unaltered kino is dissolved. These insoluble portions consist principally of difficultly soluble extractive. A sufficient quantity of boiling water dissolves the whole; and on slowly evaporating the solution, the difficultly soluble extractive separates in tough red films.

"Both alcohol and pyroligneous spirit dissolve a considerable portion of the 'butea kino,' but far less than water. Ether dissolves but little, and remains colorless; when a portion of ether is agitated with a strong aqueous solution, it soon becomes thick, and on evaporation, yields a considerable portion of tannin.

"A small quantity of persulphate of iron changes the color of the aqueous solution to a dirty green; in rather larger quantities occasions a copious green precipitate.

"A series of experiments were made on the effect, of various re-agents on solutions of this kino, with a view to ascertain which were the best precipitates of the red color, either for dyeing, or as a pigment.

"Solutions of most acids, and acid salts, changed the colors to a light orange, and for the most part occasioned copious precipitates; they were nearly all of a dirty yellow or orange color.

"When a few drops of a strong solution of caustic potassa were added to the aqueous solution of the kino, the color was immediately altered, and very much improved, becoming of the most splendid crimson; when, however, a little more of the solution of

potassa was added, the color rapidly became gray, and a copious precipitate fell. It very quickly became dark-reddish gray, and nearly the whole of the color was destroyed. Caustic soda, and ammonia likewise improved the color in the same way. When acids were added to solutions thus precipitated, so as just to neutralise the alkali, some of the precipitate redissolved, and the rest became orange. Carbonates of potassa and soda both very much deepened the color of the solution: it was however not to be compared in beauty of color with the solution obtained by the addition of a small quantity of caustic potassa, and had a slight brown tinge. In general, most saline solutions occasioned precipitates which were either pink, gray, or colors between the two. Acetate of lead, as well as several other metallic solutions, precipitated the whole of the coloring matter. The precipitate obtained by adding a solution of alum either to a neutral solution, or to one containing a small quantity of alkali, was of a dirty pink color. When gelatinous or recently precipitated alumina was agitated with any of the highly colored solutions, it soon abstracted all the coloring matter, but the lake so formed was, like those formed by precipitation, of a dingy color. The precipitates formed by metallic solutions were of very variable hues, but in no case were the colors so obtained decided or brilliant. Attempts were likewise made to fix the color in the fibre of cotton, silk, wool, &c., in various ways and with different mordants; the colors were all imperfect, dingy, and variable in color, but they were very permanent. This agrees with the results obtained by Dr. Roxburgh, but as his experiments were made on the fresh substance, they were under more favorable circumstances. The cause why the colors cannot be well employed is, that the red coloring matter is so intimately combined with the tannin and gum, that whenever the one is precipitated, it carries down the other also; and hence, when we endeavor to precipitate the tannin alone, the red color or extractive is always precipitated with it: and this, as will presently appear, is in some cases a great inconvenience.

"The solution, after the separation of the precipitate, contained gum, extractive, gallic acid, and minute portions of other matters: the quantity of gallic acid was very various, but in no case did it appear to exist in any considerable proportion.

"It was difficult to ascertain the exact per centage of tannin, as it varied very much in different specimens submitted to examination. I have therefore repeated the experiments on the several portions, and shall now give the mean of some of the best results obtained.

"From the large per centage of tannin which this substance contains, as indicated by the above experiments, and from its probable cheapness, it promises to be of considerable value in the arts, and especially in that of tanning leather. As a substitute for the astringent substance now in use, its adoption in many cases from convenience or economy are self-evident and require no comments; but in the art of tanning leather so many points require to be considered, that it is necessary to say a few words on that subject. On putting a piece of pelt of prepared skin into a strong solution, it soon absorbed a considerable quantity of tannin, but, at the same time, became of a rather dark color; this is, an unfortunate quality, because, as the consumers of leather judge of its quality in part from its color, the tanners do not like employing anything which deepens the color too much. The color taken up by the leather of course varied with the solution employed, a cold solution of the kino from Mr. Beckett, giving a much lighter colored leather than a hot-made solution; that from Bombay gave a darker color, and the solution was very subject to gelatinise and become turbid; this of course would be a great inconvenience. The leather tanned with this kino was very hard and rather brittle, but it was tanned with considerable rapidity. These results were obtained on small pieces of thin skin, and I do not anticipate that it will answer at all for tanning such skins; its richness in tannin however promises well for tanning thick hides; and the results of experiments on its application to this process, now in progress, will be communicated on a future occasion."

1588.—[ ]. Arjan gond, gum of *Terminalia arjuna.*

A gum found only with druggists: is of a clear golden brown color, and quite transparent.

II. GUM RESINS.

There are hardly any of them indigenous to the Punjab, but are imported from Persia and the countries bordering on the Persian Gulf, from Kábul and Afghânistán, or from Bombay, in which case they may be either the produce of the Persian Gulf or of the Southern Provinces of India and the Islands.

☞ The *medicinal* uses of these substances have already been given under the head "Drugs."

1589.—[4102]. Kundras, kundar. (*Boswellia thurifera*, Roxburgh; *B. serrata*). Amritsar bazar; also (4128) from Lahore.

This is same as the Indian Olibanum of the Coro-

mandel coast, Central India, Behár Hills (*Boswellia papyrifera*, and allied species), and resembles Arabian olibanum.

There are two other known species of Arabian *Boswellia* yielding "labán," or olibanum, distinguished by the name "yegaar," viz., "labān maiti;" "mohr add;" and "mohr madow;" which last is identified with HOCHSTETTER'S *B. papyrifera;* and there is also another unnamed species of DR. CARTER'S. CAPTAIN PLAYFAIR, Resident of Aden, says, "that there are several other species in Africa which he has not been able to obtain."

Boswellia thurifera grows to a large size in hilly situations, from the coast of Coromandel to Central India. * * * * * * * Indian Olibanum, which is now the most esteemed, is in roundish or oblong tears, of a reddish or light yellow color, usually covered with whitish powder, from the attrition of the pieces one against the other, translucent within, having a warm bitterish taste, and having a balsamic odor, especially when warmed or burned. Specific gravity, 1·22. When analyzed by DOCTOR O'SHAUGHNESSY, a fine specimen gave—of resin, 37 parts; volatile oil, 28 parts; gum, 4; gluten, 11; in 100 parts; but the quantity of volatile oil is much less when olibanum has been exposed to the air and the resin becomes dry; which is the state it is usually seen in commerce. BRACANNOT obtained only 5 per cent. of volatile oil; of resin, 56; gum, 30; substance like gum, 5·2; loss, 0·8 = 100.

The African or Arabian olibanum is in yellowish tears, and irregular reddish lumps or fragments.* The tears are generally ovoid, oblong or rounded, not very brittle, with a dull and waxy fracture, softening in the mouth and bearing much resemblance to mastic, from which, however, they differ in their want of transparency. The reddish masses soften in the hand, have a stronger smell and taste than the tears. Both LIEUT. WELLSTED and MR. JOHNSTON state, that large quantities of olibanum are exported from the Somauli coast.

African Olibanum, known on the continent as *Encens d'Afrique* and *Africanischer Weihrauch*, is imported into Venice and Marseilles from Suez, being obtained from Arabia and the east coast of Africa. DR. PEREIRA, who mentions it as African or Arabian olibanum, describes it as being in smaller tears than the Indian variety, yellowish or reddish, and intermixed with crystals of carbonate of lime. DR. MALCOLMSON writes to me from Aden, that large quantities of Olibanum are produced in Africa, principally on the high and extensive range of limestone hills of the Somauli coast, which are in the vicinity of Cape Guardafui. CAPTAIN KEMPTHORNE, of the Indian navy, describes the tree which produces frankincense on these hills, at about 1000 feet of elevation in the neighbourhood of Bunder Maryah, and that the olibanum is carried to the Arabian shore by boats from Maculla. "The tree attains a height of about 40 feet, firmly attached to the bare limestone rock, by a thick mass of vegetable substance (part of the tree), which sends roots in the crevices of the rock to an immense depth."—*Malcolmson.* "CAPTAIN K. describes the bark as consisting of four different layers. The outermost of all is very thin, and similar to that of the beech. The two next are of a singularly fine texture, resembling oiled letter-paper, perfectly transparent, and of a beautiful amber color. It is used by the Somaulis to write upon. The inner bark of all is about an inch thick, of a dull reddish hue, tough, and not unlike leather, but yielding a strong aromatic perfume. The wood is soft and white. By making a deep incision into the inner rind, the gum exudes profusely, of the color and consistence of milk, but hardening into a mass by exposure to the atmosphere." By this bark, of which he received a specimen from MAJOR HARRIS, MR. BENNETT, of the British Museum, has been able to identify it as being very similar to that of a tree, of which specimens were collected by SCHIMPER in his Abyssinian journey, on the mountains below Dacheladschezanne. It flowers in December, and ripens its fruit in April. Of this the Abyssinian name is stated to be *makker.* It has been named *Plösslea floribunda* by ENDLICHER, in *Nov. Stirp. Mus. Vindob., Decad.*, No. 47, and figured in *Iconogr.* t. 129, 130. He has attached it in his *Genera Plantarum*, p. 1073, as an anomalous genus to *Sapindaceæ.**

This gum resin is called (Olibanum) *quasi* Oleum libani, called in Arabic "labbán" and "alk-ul labán," (not "lubán," which is the Urdu for "styrax" gum Benjamin). DR. CARTER mentions an Arabic writer, IBN BATUTA, who calls this gum "alkundaru." The Indian olibanum, is called "ganda barosa," and "salai" (Beng.) This is supposed to be the frankincense of the ancients, and is still used in Roman Catholic churches for incense. When powdered and burnt on charcoal it gives off whitish fumes and a very agreeable odor; to the taste it is aromatic, not so bitter as myrrh (bol), but having a flavor that reminds one of cheese.

* All this is taken from a Paper by DR. ROYLE on Olibanum.

* Since this paper was written, the genus *Plosslea* has been abandoned, and the African trees fully admitted to be *Boswellias.* This was anticipated by DR. ROYLE, both in the paper from which this extract is taken, and also in his "Illustrations of Himalayan Botany," at p. 177.

The tree producing this gum resin, *B. thurifera* (*Terebinthaceæ*) is said to grow on the mountains of the Coromandel coast, and in Central India.

The "Makhzan-ul-adwiyah" says, that "kundar" comes from Yaman, and the U'mán daryá (shores of the Gulf of Ormus), thus acknowledging only the Arabian olibanum. As our Punjab olibanum comes from Bombay, it is most probably this kind we get, and not the Coromandel olibanum.

BIRDWOOD gives as its habitat Arabia and the Troglodyte country. It comes to the Punjab by Bombay principally; but may also come overland by Herat and Mashhad.

In the "Technologist" for July 1864* "elk-al-labán" (olibanum), is mentioned as being sold in the bazars of Bághdad at 10*d.* to 1*s.* per lb., and the writer says, that it is imported from Kurdistán. DR. BIRDWOOD† quotes MR. VAUGHAN, who enumerates the species of "labán" collected by the various tribes of Somáli Arabs, and found in the Aden market. They are "labán maiti," from Bandar Mait; "labán nánkar," from Bandar Aungure, and the country of Door Muhammad. These are brought by the Abardagahala Somális; "labán barbara or masliká," is brought by the Ayal Yunus and Ayal Hamid Somális; "labán makur," from several places in the Warsangli and Mijrthín Somális, about Cape Gardafui. Some of this finds its way to Bombay; but the commonest kind brought to Bombay is the "Arabian olibanum" which, writes BIRDWOOD, is exported from the ports of the Hadramaut (a province of Arabia Felix) in enormous quantities to Bombay, and thence shipped to all parts of the world.

CARTER, as quoted by DR. BIRDWOOD, writing of the Arabian "labán" district, says: "Coming from the N.E. we first met with the frankincense trees, on the Sabban mountains, in latitude 17° 30′, N., and longitude 55° 23′, E., where the desert ends, and the wooded mountainous region begins, and following the coast, which runs south-west, we found the frankincense exported from the different towns gradually diminishing after the bay of Alk'ammar until we arrive at Makalla, from whence none is exported from the interior of Arabia."

With regard to Indian olibanum, which is the produce of *Boswellia thurifera*, which COLEBROOKE called *Libanus thurifera*. COLEBROOKE positively indentifies this with the costly frankincense of the ancients; but Arabia Felix is a much more likely source for that than the coast of Coromandel. BIRDWOOD quotes Belgaum also as its habitat, but I do not find Behár noted, though DR. HOOKER* describes the plant thus in the Behár hills: "We continued to ascend to 1,360 feet, where I came where a small forest of the Indian olibanum (*B. thurifera*), conspicuous from its pale bark and spreading curved branches, leafy at their tips: its general appearance is a good deal like that of the mountain ash. The gum, celebrated throughout the East, was flowing abundantly from the trunk, very fragrant and transparent."

It was formerly believed that this olibanum was yielded by a juniper, but as the article in question is a *gum* resin, it cannot be yielded by a juniper (*Coniferæ* only yield true resins). But no doubt, as BIRDWOOD remarks, some of the European frankincense is the product of a juniper, and that the common frankincense is a resin derived from the *Abies excelsa.*

In America there is a pine called the frankincense pine. It is remarkable also that the name "gandha-baroza" is given as a synonym for this olibanum (which, though it is not much used I believe in Upper India, is no doubt in use in other parts. "Ganda-faroza" is the native name given to *B. thurifera* in the Madras Jury Report on Gums, 1857, 9·0); and "ganda-baroza" is a common name for the unctuous turpentine exuding from the *Pinus longifolia* of the Himálayas. DR. ROYLE† also writes, that in Kanáwar, *Juniperus religiosa* or *J. recurva*, is called "gogal" (the name applied to produce of *Amyris*, and the resin burnt as incense, which fact again brings the *Conifers* and the *Balsamodendrons* together.

COLEBROOKE has written about the Coromandel olibanum in the Asiatic Researches, Vol. IX., p. 377. Olibanum contained on analysis of 100 parts,

Volatile oil, ...	8·0
Resin, ...	56·0
Gum, ...	30·0
A gum like substance insoluble in water and alcohol, ...	5·2
Total, ..	99·2

This "kundras" readily dissolves in spirit, forming a flocculent milky liquid.

A sample called "kundar" or "kundal" from Amritsar was unlike the above, being of a very dark brown, but clear, and without much admixture of foreign substances. It crushes like a resin into a whitish powder, burns with a somewhat pleasant smell, but not so strongly fragrant as the Arabian olibanum,

* "The Technologist," July 1864, p. 541.

† "Economic Products of Bombay," p. 24.

* "Travels in the Himalayas," Vol. I., p. 29.

† "ROYLE'S Illustrations," p. 351.

and it has not the peculiar taste that the Arabian frankincense has. This species may be the produce of *B. glabra*.

Dr. F. Watson describes* "kundar" as covered with a "white bloom:" this is only that the surface of the pieces rubbing together partly scarifies the surface into the white powder that all solid resins can be reduced to on pounding or grinding.

1590.—[4135]. "Bol," myrrh. Lahore bazar. Ram Singh, Druggist.

Produced by *Balsamodendron myrrha (Nees; Von Esen.)*, (N. Ord. *Amyridaceæ*). It grows in Arabia, where there is also an inferior kind, called "baisa bol;" or "hebbakhade" by the Súmalis. Dr. Birdwood mentions that inferior myrrh, in Bombay, is called "baisa bol." I suspect that this sample is "baisa bol." Since writing this I have obtained two samples of "bol" from the bazar, both are perhaps from a *Boswellia*, but certainly different *species*; one, the 1st quality, being a dark reddish brown, like "gúgal;" the other (inferior "bol") a pale yellowish color with the whitish dust outside, resulting from the rubbing together of the pieces in carriage.

The sample I describe from is a gum resin having a texture like "kundras," but of a clear pale brown color, with the same whitish powder on the pieces, it might be mistaken for a dull colored specimen of "kundras." It is very bitter to the taste, and on being burnt yields a pleasant odor, but not very powerful. This is exclusively imported from Bombay, whence it comes from Arabia. Pliny says, that in his time there were six different kinds of myrrh which grew in Arabia: he says myrrh was often adulterated with mastic. The proportions of gum and resin in this substance, are, according to Dr. Thomson, 34·68 gum, 66·32 resin.

In a list of Baghdád drugs, before alluded to, myrrh is noticed as coming from Mekkah.

1591.—[4095]. Gúgal. Amritsar bazar.

(4125) Lahore.

(4169) Dera Ghází Khán.

This is called Indian Bdellium; its synonyms are given as "mukal" (Arabic); "ranghan turb" and "aflatún." In Syrian, the "Makhzan-ul-adwyia" says, it is called "badliyún," which is like a corruption of βδέλλιον, Bdellium.

This is sometimes mixed at Bombay with myrrh.

The "gúgal" is the produce of *Balsamodendron Roxburghii*; (*Balsamodendron Mukal;* Roxburgh), *Amyris agallocha*, *Amyris commiphora*, and allied species. (This is unlike the resin of *Boswellia glabra*, called on the Telugu coasts, "gúgulá").

Dr. Roxburgh says, that the *Balsamodendron* is found in Assam and Silhet, and districts to N. and W. E. of Bengal.*

It is certainly common in the Sulaimaní hills, on the Punjab West Frontier,† in the Sindh Forest Report for 1862-63, I find that a tree is mentioned as abundant in the Soorjani hills, called "bye" (*sic. in original*), which is said to be a *Balsamodendron*.

"Gúgal," is also mentioned by Lieut. Carless, in his account of Kuráchí, as coming from Las, in the province of Beila, to the north of Khelat.‡

"Gúgal" is also brought into the district of Dera Ghází Khán, to the amount of 300 maunds a year, by the lower passes of the Dera Ismaíl Khán district and the Sanghar pass.§ It sells in the Dera Ghází Khán district for 2 seers to the rupee.

The samples are of a somewhat soft and not brittle texture, golden brown, but outside dull and darker color. The taste is a peculiar aromatic earthy taste, quite unlike the bitter of the foregoing species. It burns readily with a slight but pleasant smell.

There can be little doubt that the hills of Bilúchistán, and still further, are the source of "gúgal" imported into the Punjab.

The "Makhzan-ul-adwiya," localizes "gúgal" to Daryá Umán (Gulf of Ormus), and Shanjár (a province of Arabia Felix), and says, it is found in Hindustán, which is likely true enough.

1592.—[4119]. Jaushír, or gaushír. Lahore bazar; also from Amritsar (4097).

Gum opoponax (*Pastinaca opoponax*), *Opoponax chironum* (Nat. Ord., Umbelliferæ), has its habitat on the shores of the Levant and Asia Minor.

This is one of the less known gum resins, exuding from *Umbelliferous* plants. From the appearance we would class it with "ushak" (*Ammoniacum*) and assafœtida.

Two samples of the gum are before me—one, the best, in small rounded tears, is whitish yellow inside, and a decided yellow outside; it has a texture almost like wax—indeed wax is used to adulterate it—it softens to heat, and burns not very readily, with a peculiar smell.

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* Indian Catalogue International Exhibition of 1862. Class V., p. 108.

* Royle's Illustrations, p. 177.

† Sind Forest Report in M.S. among Records Financial Office. "Forests."

‡ Bombay Selections. Sindh. XVII., p. 202.

§ Pollock's Report, Punjab Corespondence, Vol. IV., Part 4, p. 64.

It has a peculiar and very bitter taste, which suggests to me that it was once a liquid milk coming from some nitrogenous plant or root. The smell is similar to "ushak," but not so strong or disagreeable. The inferior quality is in large pieces, as if it were a residue or second extract, having the same general qualities, but a dirty whitish color, and a dirty brownish color outside.

When dissolved in spirits it becomes like milk, which it also does when ground up in a pestle and mortar with water (in which way it is given by native doctors as a medicine) : it is to this peculiarity, no doubt, that this name of "gaushír" (cow's milk) is due. It is also, I believe, given with vinegar, in which it is completely soluble, forming a thick milky liquid. "Gaushír" from the absence of the letter "g" in Arabic, has been turned into "jau shír" ; this shows, I think, that it had its origin in a Persian speaking country, as its original name is Persian. The "Makhzan-ul-adwiya" confirms this, and observes that it comes from a village called Máh, near Ispahán, where also "sakbinaj" is produced.

It gives also a name of "jáhoshí" at Shiráz ("hoshí" is the name by which Dr. Lindley obtained it at Bilúchistán—the fact is remarkable).

Royle says that "jawashír" is imported into India from Arabia, and into England from Asia Minor. He says that Dr. Lindley had some seeds sent from the hills of Bilúchistán, which were called "háshí," and were then considered to be the *Opoponax*.*

The "Makhzan" describes the plant as "having abundance of close set stalks, somewhat tall, and covered with a white down. Its leaves are described as like those of the fig tree. The flower head, 'kubah,' is like that of the 'shibt' (*Anethum sowa*), the flowers being yellow and scented. The seeds are black like anise, and have an aromatic smell (tund)."

The author goes on to state that the gum is obtained by taking up the root at the time when the plant begins to sprout, and breaking it open, and allowing the juice that exudes to concrete on leaves placed below.

An inferior kind, he adds, is made by mixing up wax and ammoniacum by way of adulteration with a little of this gum.

From this it is clear that the plant is *Umbelliferous*.

Dr. Royle does not give any authority for the statement that *Opoponax* comes from Arabia, and I am quite unable to discern any evidence in support of the statement.

"Jawashír" occurs in the bazars of Baghdád (it sells for $10\frac{1}{2}$*d.* per ℔.), and is imported from Persia, which confirms the statement in the "Makhzan-ul-adwiya."*

Lindley† says also that *Opoponax* is the concrete juice of *Opponax chironum*, inhabiting the Levant. I believe that the origin of the Punjab druggists' "jaushír" is Persian, and the countries to the south as far as Bilúchistán. The Persian origin of the names and the coincidence of the Bilúchistán name, and the Shirazi names, "háshí" and "jahúshi," are confirmatory of the supposition.

In Lahore the gum sells at 6 annas a seer. At Amritsar I recently obtained a sample, which the owner assured me had come direct from Bushire, and was of superior quality. It was in quite small tear-like pieces of a dark tawny reddish yellow outside, and whitish inside ; being much smaller and darker than the ordinary samples.

1593.—[4096]. Sakbínaj. (*Sagapenum* of drug-writers.) Amritsar bazar; also Lahore (4106).

Value, Rs. 5 a seer.

Named *Ferula persica* (W.); in Hindi, "kundal" (not to be confused with "kundar" *olibanum*) ; but the plant from which it is derived is quite uncertain.

Dioscorides, iii. 95, says, it is produced by a "ferula" growing in Media. Ainslie‡ quotes Dale and Miller, who say that it is brought to England from Alexandria.

The "Makhzan-ul-adwiya" says, it is found near Ispahan, at a village called Máh.

It is extremely difficult to obtain, and very costly. With great difficulty I obtained a small piece for Rs. 2, from Pandit Hiranand, who was a companion of Dina Nath, and had travelled much in Khorásan and Bukhára. The piece is very like "ushak," with a white waxy appearance and yellow outside, part of which had been removed.

The druggists if asked for "sakbinaj," as none of them have the real drug, produce "jaushír," or "ammoniacum."

It is supposed to be both antiseptic and alternative in medicine ; it is still used in European medicine, being an antispasmodic and emmenagogue. The proportions of gum and resin are given by Ainslie. Resin, 54 ; gum, 31 ; and 12 of volatile oil.

The sample (4096) exhibited as "sakbinaj," from Amritsar, was evidently not "sakbinaj," but a dark massive gum resin, full of little sticks and impurities ; which, when broken exhibited when it powdered in

* Royle's Illustrations, p. 231.

* "Technologist," July 1864, p. 542.

† Veg. King., p. 776.

‡ Mat. Med. I., p., 358.

breaking, a green color; it had a bitter taste, and a somewhat alliaceous smell when broken.

1594.—[4105]. Bárzad (baríja) *Galbanum.* Lahore druggists.

The sample actually exhibited under 4105, proved not to be the *Galbanum*, but I have, nevertheless, included the name and number, as the real gum *Galbanum* is used in native medicine; but it is rare and scarcely anything is known of it.

It is referred to *Ophoidia galbanifera* (Don), and *Galbanum officinale* (Don). In the "Alfáz" and "Makhzan-ul-adwiya," "kinnah" and "nafil" are given as the Arabic names; and "kalbániya" (χαλβανη); as the "yunáni" or Greek name; the Turkish, "kási." The author adds, that the Dictionaries give "ganda bihroza:" and by this latter name it is known. This proves that the real drug is almost unknown: "ganda bihroza" is quite different, but always sold for "barzád."

There appears to be two kinds of *Galbanum*—Levant and Persian. The Persian, which is the one which comes to India, is yielded by *Ophoidia galbanifera.* The specimens above quoted are not the real "barzád," which I have been utterly unable to obtain. Whenever I asked for "bárzad" and "baríja," I invariably got a pot full of the semifluid sticky whitish "ganda baroza," or crude turpentine of the *Pinus longifolia.* "Bárzad" was also sent me of three qualities, which were also as far from the real article as the last-mentioned; the 1st has a clear transparent yellow resin, the transparent yellow passing occasionally into a semi-opapue cloudiness, and occasionally into spots of darker colored brown yellow. I do not think it is a pine resin; but probably a *Shorea* or *Vatica* resin. The author describes the plant yielding this gum resin, as similar to that producing "sakbinaj," and with leaves like the "chinár:" one kind of this gum is yellowish white, and another reddish yellow, and of considerable weight, which latter is the best. The author adds, that the specimens known have been obtained from a "conifer" as big as a cypress, and like the "dahoni balsán" *(Balsam of Gilead)*, and says that it is called "labání" deodar; and then goes on to describe the common pine resins, which are always sold in druggists' shops in lieu of the real drug. That given as 2nd quality was a piece of clear resin, slightly wrinkled on the outside, and of a olive green color; when a piece was broken off, might easily have been mistaken by its fracture and transparency, for a piece of bottle glass. By its smell it is evidently a purified pine resin of some kind. 3rd piece, called "bárzad" third quality, is a piece of common impure black pine resin, or "colophony."

1595. [4121]. Ammoniacum, "ushak." Lahore druggists. A sample also from Amritsar (4094).

This is the last of that series of Umbelliferous gum resins, *Opoponax, Galbanum, Sagapenum* and *Ammoniacum,* that resemble each other so much in their texture, smell and color. The gum is yielded by *Dorema ammoniacum.*

'Ushak has an amygdaloid structure, like a series of tears of the gum agglutinated together: it yields to the nail like wax, softens to heat, and if pulled apart draws slightly into threads; inside it is waxen white, outside brownish yellow. It has a slight nitrogenous vegetable smell, but when a little bit is taken between the finger and thumb, and rubbed and heated, it gives out a pungent and highly disagreeable odour, suggestive of its vegetable origin. This is the least valuable of these series, being priced at Rs. 2 per seer, while "jaushír" is Rs. 10; for this reason it is used to adulterate and counterfeit the others.

1596. [1926]. Assafœtida. Lahore bazar. And root of the *Narthex assafœtida,* dug up at Pangi, in the Chenáb valley, the most southern locality in which it has yet been found.

Narthex assafœtida. This is called "híng" in Hindí; "angúzah" in Persian; "hiltít" in Arabic; "anjadán" is also given as a synonym (AINSLIE, I., 21); and "samagh-ul-mahrús" (gum of the mehrus root) in the "Alfáz adwyia." "Juwífeh" (Arabic) is a name given in the bazar of Baghdád.*

The "Makzan-ul-adwiya" gives "anghozah," or "angazad;" or in Ispahán dialect, "ankasht kundah."

Its botanical synonyms are *Ferula assafœtida* (L.), and *Ferula persica* is also given as a source of assafœtida (Lindley, V. K.)

BIRDWOOD says, that the botany of this plant "is not yet properly determined, for although *Narthex assafœtida* certainly yields the drug of commerce, a portion is probably contributed by other Umbelliferous plants.†

Assafœtida is the type of the Umbelliferous gum resins, at the end of which series I have placed it. DR. LINDLEY remarks:‡ "All the Umbelliferous plants appear to form secretions, in which there are three different principles.

1st. Some of them yields a watery acid matter from their roots, rendering them quite poisonous.

2nd. Some of them have milky secretions, consist-

* "Technologist" for July, 1864, p. 542, where it is added that the gum is sold for *7d.* per. lb. troy, and comes from Persia.

† "Economic Products of Bombay," p. 42.

‡ Veg. King., p. 775. *See* also ROYLE'S Illus., 231.

ing of mucilage and essential oil, which hardens into a gum resin ; and,

3rd. Is when the plant has a peculiar aromatic oil, in which case it becomes carminative in effect, and has aromatic qualities, such as dill, anise, carraway, and coriander ; when all three principles are absent and merely mucilage and sugar are found in the root, they are nutritious as food, *e. g.*, carrot, parsnip, &c.

AINSLIE* quotes CAPT. MACDONALD KINNEIR, who states, that assafœtida is a staple article of export from Herát, in Khurasán ; he says, that the leaves are used as a vegetable, and the root is also roasted.

The gum is obtained from the root when the plant is four years old.

The following account is extracted from an account by DR. BELLEW (Guides Corps), of assafœtida as seen by him on his journey to Kandahár. This extract will be found in Appendix VII. of MR. DAVIES' Report.

"The frail vaginated stem, or the lower clusters of sheathing leaves, the former belonging to old plants and the latter to young ones, is removed at its junction with the root, around which is dug a small trench, about six inches wide and as many deep.

"Three or four incisions are then made around the head of the root, and fresh ones are repeated at intervals of three or four days ; the sap continuing to exude for a week or fortnight, according to the calibre of the root. In all cases, as soon as the incisions are made, the root head is covered over with a thick bundle of dried herbs or loose stones, as a protection against the sun ; where this is not done the root withers in the first day, and little or no juice exudes.

"The quantity of assafœtida obtained from each root varies from a few ounces to a couple of pounds' weight, according to the size of the roots, some being no bigger than a carrot, whilst others attain the thickness of a man's leg. The quality of the gum differs much, and it is always adulterated on the spot by the collectors before it enters the market. The extent of adulteration varies from one-fifth to one-third, and wheat or barley flour, or powdered gypsum, are the usual adulterants. The best sort, however, which is obtained solely from the node or leaf-bud in the centre of the root head of the newly sprouting plant, is never adulterated, and sells at a much higher price than the other kinds. The price of the pure drug at Kandáhar varies from four to seven Indian rupees per "man-i-tabriz" (about three pounds); and of the inferior kinds, from one and-a-half to three-and-a-half Indian rupees per "man." The assafœtida is commonly used by the Mahommedan population of India as a condiment in several of their dishes, and especially mixed with "dál." It is not an article of general consumption in Affghánistán, though often prescribed as a warm remedy for cold diseases by the native physicians, who also use it as a vermifuge.

"The fresh leaves of the plant, which have the same peculiar stench as its secretion when cooked, are commonly used as an article of diet by those near whose abodes it grows. And the white inner part of the stem of the full grown plant, which reaches the stature of a man, is considered a delicacy when roasted, and flavored with salt and butter."

DR. BELLEW, in another communication says, "that there are two sorts of assafœtida—that which occurs 'in tears,' is the gum that exudes, drop by drop, from incisions made in the top of the root. The lump assafœtida is that which exudes when the root is sliced across, and the juice coagulates." DR. BELLEW adds, "that there several Umbelliferous plants, especially on the slopes of the 'Safaid Koh,' which exude a milky juice, but which is not collected." Certainly the lump sort is the commonest in the bazars. I have found thin slices of the root mixed with samples of the gum. Assafœtida was brought to me of two colors—one a dirty pale brown, the other with a red or salmon-color ; but both similar in texture.

There is a variety of assafœtida, called "stony assafœtida," on account of its containing fragments of gypsum, about 50 per cent. ; this may be caused by the gum being allowed to drop on the ground of the hill side, where gypsum occurs, and then the whole scraped up together, gum, earth, and all. In the Great Exhibition of 1851, there was an assafœtida unlike others, of a brown colored pellucid appearance, full of bits of stalks. This renders the supposition probable that assafœtida is produced by more species than one.

The "Makhzan-ul-adwiya" enumerates two kinds—one called "tib," and one "munattan."

Tib is white assafœtida ; called also "kolahpar."

"Munattan" is dark assafœdita; called in Persian "kamát."

The former is the best kind. The author adds that assafœtida grows at Herát.

There is no doubt that assafœtida is produced in Khurásán and the Southern Provinces of Persia, and in Bukhárá and in Bilúchistán ;* as also at Pangi, in the Chandrabhága valley, and other places in the hills of the Punjab, &c.

This last locality, which is the most Southern habitat yet known for the drug, has been established beyond a doubt, by the large root brought down by DR. CLEGHORN, and now in the Lahore Museum ;

* Mat. Medica, I., 21.

* Bombay Selections, XVII.

the root is thick and fleshy, and after growing downwards in one piece, branches of into a number of fleshy tubers, and then again into others, like a large tooth with many roots. On being cut, it gives the unmistakeable smell. MACCULLOCH* says, it grows in Sindh, but this I believe is without foundation, and the idea is derived from the fact that assafœtida will be found in quantities at Shikarpúr and Hydrabad in Sindh, but then it is brought thence from the North of Kabúl and Bukhára provinces.

In India, assafœtida is chiefly obtained overland by the Bolan pass, and by the Peshawur passes, but large quantities are shipped from various parts of the Persian Gulf, and are thence taken to Bombay for export to Europe: the smell is so offensive, that sometimes ships are exclusively employed in the Persian Gulf to carry this gum.

It would have been hardly necessary for me to allude to the celebrated "asadulcis," except that PEREIRA has mentioned the two together.

This "asadulcis" or "laser" (*Laser cyrenaicum*) was the produce of a plant *Thapsia sylphium*. In ancient Cyrene, so sovereign were its virtues supposed, that the figure of a plant corresponding to the *Thapsia* was wrought upon several Cyrenaic and Barcæan coins; and BIRDWOOD mentions, that there is an antique vase extant, having a representation of King Arcesilaus weighing out the drug for sale. PEREIRA quotes AVICENNA, who says, there are two kinds of "asa," one sweet, the other fœtid (*Asa dulcis* and *A. fœtida*). The Cyrenaic "laser" was soon exhausted, not obtainable even in the time of PLINY.

1597.—[4136]. Farfeyún, gum of *Euphorbia*. Lahore bazar; also from Amritsar (4099).

This is given by BIRDWOOD as *Euphorbia canaariensis*: its Persian name is "shír-i-dirakht-i-zakúm," and Arabic, "akal nafsah." The *Euphorbium* known in Europe is very likely the juice of *G canariensis*; but I have no doubt that the *Euphorbium* of the bazars is produced from *E. antiquorum* and other species. It is a remedy for rheumatism. AINSLIE says, it is prepared by boiling with sesamum oil, but the exhibited samples appear to be the plain coagulated and dried juice. The "Makhzan-ul-adwiya" says, it dissolves easily in water and in olive oil.

The "Makhzan-ul-adwiya" says, that "farfeyún" comes from the cities of Barbar and Rahil, so the gum gets called "Barbariya" (perhaps he means North Africa. King JUBA, of Mauritania, is said to have discovered the juice, and called it after his physician, EUPHORBUS). It is the gum of a tree called "fafkah" but the "Makhzan" says, that the plants yielding this are two—one with lettuce-shaped fleshy leaves, full of milk and bearing thorns (cactus species ?); the other kind of plant has dark colored leaves (siya), and spreads on the ground; it also has sharp thorns.*

To the natives generally no other use of *Euphorbia* juice is known, but that of a medicinal gum, but lately several papers have been communicated to the Agri.-Horticultural Society of the Punjab, as to some further uses. I append an extract from the Proceedings:—

The following letter (dated Jummoo, 2nd December) from F. DREW, ESQ., was read regarding a gutta-percha-like substance derivable from various indigenous plants.

"In answer to your note, I forward by bangy-dak, four specimens of the substance to which, I think, MR. COOPER must have referred. You will better than myself be able to say what name it should be called by. It is MR. RATH, Mechanical Engineer to the Maharajah, who has made the experiments, which have resulted in the production of this, which he says is of considerable use to him for various purposes connected with machinery.

"It is procured by boiling down the milky juice of the common cactus, which here abounds in hedges and on the lower hills; after having brought it by this means to the consistency required (which may vary according to the use it will be put to) it can be purified by adding dates (? *sic.*) and boiling this away, taking off the scum as it rises; then by pouring cold water on it will so far solidify that it may be easily taken out of the vessel.

"MR. RATH has also prepared similar stuff from

* Commercial Dictionary. Art.—Assafœtida. The article is so important that I quote from it to illustrate the commerce of this article. "It is imported packed in mats, casks and cases, the latter being in general the best. It should be chosen clean, fresh, strong scented, and of a pale reddish color, variegated into a number of fine white tears, which, when broken should somewhat resemble marble in appearance, and after being exposed to the air, should turn a violet red color. That which is soft, black and foul, should be rejected. It is chiefly re-exported, being used in England only as a medicine, but in France also in cookery. In London its price varies from 12*s.* to £4 per cwt." The use of assafœtida in France is similar to its Indian use, where it is often put into food, being regarded as digestive, and a great preventive of flatulent disorders. It is constantly eaten also by women to facilitate childbirth, and is taken in cases of abortion to promote expulsion of the fœtus.

* The various names given in the "Makhzan" for this drug are—Afarbyún, farbyún, barbayún; farfaryún, abrfayún. In Turkey—Afinan (Arabic), ákil bunafshah, and kátil banafshah; háfiz-ul-nihl, hafiz-ul-at fál, kardish-ul-ghinnam; in Greek—Hálás, tákúb, kamúlyún; and in Syria and Egypt—Bustáná; laban us-saudá, laban-i-maghrabiyá, berberya.

the pípal tree (by cutting into the trunk for the sap to flow out) and from the bér tree, but the best he has found to come from the cactus.

"MR. RATH says, that although in the spring time a greater quantity of sap flows, yet a larger *proportion* of the gutta-percha-like substance is gained from the sap that is taken at this time of year."

The cactus is probably the *Columnar euphorbia* (*E. Royleana*) common in the low hills near Jammú.

MR. DREW subsequently wrote.

"I have enquired of MR. RATH more particularly the uses he puts the substance he gets out of the *Euphorbia* to. He mostly uses it for *Steam joints* instead of red-lead, also when mixed with oil, it can be laid on as a water-tight coating to any cistern, &c., and even MR. RATH believes it would do well for a preservative coating for boats.

"I do not know that there is any other purpose to which it has as yet been applied."

On the same subject, the following memo. had been forwarded by DR. JOHNSTONE, Gujrát:—

"COL. GARDINER directed my attention to the experiments made by him of extracting the milky juice of the "doof," which yielded a substance analogous to caoutchouc; the experiments were conducted first by sun-drying the inspissated juice; second by infusion, an extract being prepared from the watery solution.

"I prepared a small quantity by boiling up the "doof." COL. GARDINER could give me no information about the plant itself. I inferred it was a *Euphorbia.* In the vicinity of Kashmere I found *E. verrucosa*, "safaid-hirbí;" *E. longifolia*, "zard-hirbí;" *E. agraria*, "siya-hirbí." The root of the *E. longifolia* I conclude is the "doof" of the Hindoos, on the following grounds. The root of *E. longifolia*, which abounds in the Peer Punjal range, is of the same size and similar consistence; and on exposure to sunlight and air, assumes the same color. Moreover, the reputed leaves of the "doof" sold at the Devee Dwarrah in the Jummoo Raj, the yearly rendezvous of thousands of Hindoos in October, which I obtained from thence, are the leaves of the *E. longifolia.*

"'Catimandoo,' which has been prepared both in Arabia and Persia, is the inspissated juice of the *Euphorbia antiquorum* (?) and quite similar in character to that of the *E. longifolia.*

"I believe gutta-percha, or rather 'catimandoo,' might be prepared from any of the *Euphorbias* by incising their stems and allowing the milk to form into agglutinated tears, or by collecting and boiling it, as I have seen with the juice of the *Horea* in Demerara and Brazil.

"BRANDE gives the analysis of East Indian *Euphorbia* juice as—

"Resin, 60 per cent.

"Wax, 15 per cent.

"Malates of potash and lime in variable quantities.

"Caoutchouc in variable quantities.

"The active principle is the wax resin, and has been added to the *Acetum cantharides* (Edinburgh), to intensify vesication. I believes there exists a greater amount of 'catimandoo,' and less wax resin than BRANDE makes out. Perhaps he analyzed the Plains *Euphorbia.*

"It might be interesting to compare the analyzed juice of the

"*Urceola elastica* (*Gumtavan* of Malay.)

"*Ficus elastica.*

"*Bassia elliptica.*

"*Siphonia caoutchouc*, *Horea* of S. America, and the Hill *Euphorbia* or 'hirbí.'"

1598.—[ ]. Akákiá. Lahore bazar.

A black or brown highly astringent exudation from the seed vessels of *Acacia vera.*

1599.—[ ]. Sakámuniya.

Properly, as its name implies, the extract of scammony; but a spurious kind is sold, which is a black resinous compound.

1600.—[4137]. Hukm chíl, or gond-i-chuhára.

Is a glossy dark-brown gum. The samples exhibited were soft enough to be flexible. It is produced by the date tree (*Phœnix sylvestris*).

1601.—[ ]. 'Usárá rewand, gamboge.

Cambogia cochinensis (Kœnig). *Garcinia mangostana*; *Gambogia gutta* (L.); and *Hypericum pomiferum* (Roxb.); are sources of gamboge. Siam and Cochin China are the great places of production.

A gamboge tree abounds on the Ghâts on the Canara coast, and among the Wynaad mountains (*C. tinctoria*). Ceylon gamboge is produced from *Hebradendron cambogoides.* The gamboge seen in the shops, consists of fragments of the "pipe gamboge" of commerce, which consist of the gum purified and formed into thick sticks or pipes: it comes from Cambodia, Siam, and Cochin China, &c.

This is exclusively imported. It is used in medicine—a drastic—and its native name, "concrete extract of rhubarb," has its origin in the belief that it is prepared from rhubarb. It is used in Europe extensively as a paint in water-color drawing. I do not think the native artists use it. This gum is inodorous and nearly insipid, but is a powerful purga-

tive or drastic, and forms the main ingredient in "Morrison's Pills," which are said to be imported into China by the hundred weight.

1602.—[ ]. Anzarút (*Sarcocolla*). Lahore bazar.

This is a brown colored gum resin, said to be exuded by *Penæa mucronata* and other species, and to have the power of agglutinating wounds, as its name (sarcolla) implies. It has a sweetish nauseous taste, and contains a peculiar principle, called "sarcocollin"* never found in any other vegetable, which has the property of forming oxalic acid when treated with nitric acid. ENDLICHER says, the drug is not likely to be the produce of a *Penæacean* plant.

1603.—[ ]. Juice of the madár or "ak" (*Calotropis Hamiltonii, C. procera,* &c., &c.)

The annexed papers are reprinted from the now scarce early volumes of the Agri.-Hort. Society of India, viz., Vol. VIII.

The "madár" plant gives out a milky juice resembling gutta percha. There was a specimen in the International Exhibition of 1862, shown by DR. SHORTT of Chinglepu, Madras; and DR. RIDDELL calculates that 10 average sized plants will afford as much juice as will make 1lb. of this gutta percha-like substance. This plant also produces in its bark one of the strongest fibres known, and is used for making fishing nets on the Indus; but it is difficult of extraction. The bark of the root resembles very much ipecacuanha in its properties.

"On the juice of the "madár" as a substitute for gutta percha, communicated by CAPTAIN MEADOWS TAYLOR.

"My dear Sir,—I observe in the last number of the Society's Transactions, that the mudár (*Asclepia gigantea*), affords a very valuable kind of hemp or flax; and I have now the pleasure to communicate to you another valuable property it possesses, which has been lately discovered by a friend here, under whose permission I make the present communications to you.

"DOCTOR RIDDELL, the Officiating Superintendent Surgeon of the Nizam's Army, had for some time been employed in extracting or determining by chemical experiments the well known medicinal properties of this plant, and during his investigation, having had occasion to collect the milky juice or sap, and expose it to the air, found, as it gradually dried, that it became tough and hard, and not unlike gutta percha. This induced him to treat the juice as that of the gutta percha tree is done, and the result has been the obtaining of a substance apparently precisely analogous to gutta percha, of which I have the pleasure to send you a specimen, bearing the impression of his seal, marked No. 1.

"The mode of preparing this substance is as follows :—

"The juice or sap to be collected by incision. An open slit may be made in the back of the plant and a pot tied to it, when it will flow into it; or it may be collected by cutting the back and catching as much as flows out at once. DOCTOR RIDDELL calculates that ten average-sized plants or bushes will yield as much juice as will make a pound of gutta percha substance, but it is not known yet how far the plant will bear tapping without injury, nor how often, or at what intervals the extractions of juice might be made.

"The juice extracted may either be exposed to the sun in a shallow vessel, or left to dry in the shade: by the former process, the substance becomes a little darker than by the latter.

"When it has attained a tough consistency, it may be well worked up in very hot water with a wooden kneader, or boiled; either process serves to remove an acrid property of the juice, as also all other matter but the gutta percha itself. It is believed that the more it is boiled and worked up, the harder it will eventually become when cool.

"Comparison with the true gutta percha gives the following results :—

"Sulphuric acid—clears it.

"Nitric acid—converts it into a yellow resinous substance.

"Muriatic acid—has very little effect upon it.

"Acetic acid—has no effect.

"Alcohol—ditto.

"Spirit of turpentine—dissolves it into a viscid glue which, when taken up between the finger and thumb, pressed together, and then separated, shows numberless minute and separate threads.

"The above chemical tests correspond exactly with the established results of the real gutta percha.

"The substance, however hard it may have become, becomes immediately flexible in hot water, and readily takes any form required, receiving and retaining impressions of seals, ornaments, &c. It has been made into small cups and other vessels which are not found to alter in form.

"A test I suggested myself was, would it unite with gutta percha? and this was satisfactorily proved in my presence. A piece of the real gutta percha of similar size, with a piece of the new substance was softened in hot water, and united readily.

"The tests by acids on the mixed substance did not differ from those on either of the two original substances. * * * * * * * *

* LINDLEY, Veg. Kingdom, 578.

"If the 'mudár' could be profitably grown for its hemp alone, it is evident, if this new substance proves in practice what it now appears to be, that an acre of cultivation of it would produce a large quantity of juice and thus materially enhance its value. The poorest land suffices for its growth, but I have no doubt that if cultivated and plentifully irrigated, not only would the yield of juice be larger, but the growth of the plant, and the fineness of its fibre when made into hemp, materially increased."

Substitute for Gutta Percha.—(From the *Bombay Times* of 4th Nov., 1852.) The following is a very interesting extract from a note from DOCTOR RIDDELL, containing an account of the experiments made by him on a substitute for gutta percha, which he believes he has discovered. The subject is most important, and if we can make a common hedge plant yield a product so valuable, and the demand for which is so certain quickly to out-run supply, a material addition will have been made to the productive resources of the country.

"I have now the pleasure of sending you the result of my experiments on the juice of 'mudár,' and which, I think, will be found to assimilate closely with all the properties of gutta percha. A nearly similar substance is procurable from the juice of the milk bush or hedge at it is called, the *Euphorbia tiracalli*, only when it hardens after boiling it becomes brittle; whilst warm it is as ductile as the other, and becomes hard quicker, without any of the peculiar scent of the *Asclepias gigantea* juice; it readily dissolves in spirits of turpentine, but is not affected in alcohol. As the juice is very acrid, and blisters the skin, giving most excruciating torture, if the slightest particle gets into the eye, care must be taken in collecting it: however, a machine could easily be made for chopping up the boughs and expressing the juice, so that it need never be touched by the hands. The juice of the elegant plant of the same species, the *Poinsettia*, which has such a beautiful effect in the garden when the leaves turn scarlet, gives a similar substance, but does not harden when cool as the other does; but is still firm enough to be twisted, and would make a good varnish in a solvent like turpentine, and then mixed with spirit. The plant grows readily from cuttings, but requires water, which the other two do not.

"As regards my experiments with the 'muddár' juice, they are as follows:—Having collected about 18 fluid ounces I had it strained through a cloth, and exposed 13¼ ounces of it to solar evaporation on a flat dish. In three days it became firm, separating itself from the dish and easily removed. I then placed it in boiling water, and worked it well about with a spatula, and when cool enough to handle, kneaded it with my fingers; when cool I found it to weigh a little more than six ounces. I then boiled it, and, as it cooled, worked it well again: and on weighing the substance, found it had lost one ounce. It was then pulled out into shreds and boiled a second time, kneading it whilst cooling, and four ounces two drachms, apothecaries' weight was obtained of what I call 'muddár gutta percha.'

"The next experiment was with four ounces of the juice, which weighed four ounces apothecaries' weight, and placing it in a bason, I poured about one quart of boiling water on it, stirring it up, and then leaving it to stand, when it broke into curds which fell to the bottom. I then partially poured off the fluid, and filtered the residue through paper, and on its being sufficiently dry to be removed, found it to weigh one ounce six drachms. It was then worked well in hot water two or three times, and formed into a mass which gave six drachms, thus losing one ounce. On the whole it will be seen that the most economical method of preparing the juice, is by solar evaporation, the residue being nearly double to that of the second experiment.

"Results of the experiment in acids, alcohol, liquor potassæ, and spirits of turpentine, on equal quantities of the 'muddár' made into small pellets, immersed 48 hours.

"Sulphuric acid—Much charred, particularly outside, cut a pellet in half, found the inside spotted, not charred throughout; the remaining part stretching like tough dough.

'Nitric acid.—Appeared converted into a yellow resinous substance, and gained about one-third in weight, which it lost again when dry; found it pliable under pressure of the finger: when mixed with water it colored it yellow.

"Muriatic acid—Colored somewhat like the sulphuric, but not so black; soft and plastic. No increase in weight. Color brownish outside, with a reddish tinge inside.

"Acetic acid—No diminution in weight whatever; apparently the same as when first immersed.

"Alcohol—The substance apparently softened, and lost a trifle in weight; spirit slightly discolored.

"Liquor potassæ—Washed it in warm water and let it dry; had yellowish tinge. Increased a little in weight, but became very ductile and adhesive.

"Spirit of turpentine—Placed one part in four of turpentine, and in 12 hours it was quite dissolved, forming a thick creamy substance; which, mixed with sprits of wine, would make a good varnish for silk or cloth."

RESINS AND BALSAMS.

PINE OR CONIFER RESINS.

I have already indicated the various gums

which are simulated in the druggists' shops by resin. I will add that the "mumiai" is often the same; and also "aluk," "zift-i-ratab;" and "zift-i-yábis," "ratiánáj," and "katrán," are merely varieties of resin, colophony, and dried tar.*

1604.—[4062]. Resin. Hills near Simla. MR. GEO. JEPHSON.

1605.—[4062]. Tar, the result of dry distillation of pine chips, both of deodar *(C. deodara)* and *P. longifolia.*

First, an earthen ghara or vessel with a wide mouth, and capable of containing about 4 seers, is sunk into the ground. Next, a large ghara of about 12 seers capacity is taken, and three small holes are drilled in its under side: it is then filled with scraps of the pine wood, and over its mouth another smaller jar is placed, and kept there by a luting of clay very carefully applied; and then both the jars are smeared over with a coating of clay. These two jars thus stuck together are next set on the mouth of the receiver or ghara sunk into the ground, and the joint or seat is made tight by a luting of stiff clay. Light firewood is now heaped around the apparatus and ignited, and kept burning from four to eight hours; the rationale of the process being that the heat causes the tar contained in the chips inclosed in the large ghara to exude, and it falls though the three holes drilled in the bottom, and into the receiver sunk into the ground. When the fire is out, the ashes are raked away, the jars very carefully separated, so that pieces of dirt may not fall into the receiver, and the latter is then exhumed, and the contents poured out. It is only necessary to replace the receiver, with the jars over it as before, duly charged with chips, and lute the joints up carefully, and the process can be carried on as before. With care the same jars may be made to do over and over again without cracking.

One seer of wood yields about 2·6 chitaks of tar, and 4·3 chitaks of charcoal. To procure a seer of tar requires 6 seers 4 chitaks of wood chips to charge the pot, and 2 maund 6 seers and 9 chitaks of chips for fuel.

1606.—[4073-5]. Samples of crude turpentine and tar, from the *Pinus longifolia.* Kangra district.

And also from the *Cedrus deodara*, the latter being used in the preparation of the large skins which are used as floats on which rivers are crossed, &c. Tar is called "chilon."

1607.—[4103]. Baroza, or ganda-baroza, the oleo-resin exuding from the "chíl," or *Pinus longifolia.* Amritsar bazar.

A sample is sent from Rawalpindi also. This is to be met with in every bazar, every tinman has a little pot of it to use while soldering metals. The "ganda-baroza" will yield, by further distillation, spirits of turpentine and rosin.

1608.—[ ]. Refined spirits of turpentine, prepared at Sealkot Mission Industrial School. REV. J. GORDON, Sealkot.

1609.—[4104]. Colophony, or black rosin, the residue after distilling the above.

1610.—[4161]. Pure rosin (red or pale rosin). Dera Ismail Khán. LOCAL COMMITTEE.

I have no accurate information as to where this fine sample was produced: it gained a prize: possibly it was imported into Dera Ismail Khán.

1611.—[4171]. Rosin as it exudes from the "chíl" tree. Peshawur.

(4129) Is a sample from Lahore.

These samples consist of the resinous tears exuded from the bark, picked off and dried.

Natives generally attach little value to turpentine, and therefore often prepare resin from the turpentine (ganda-baroza) by merely heating it in an open vessel, by which means the essential oil (spirit of turpentine) flies off, leaving the resin. This wasteful method is very generally followed.

1612. [4117]. Sundras, or sundrus; resin of the *Vateria indica.* Lahore bazar.

This resin is called by the various names of "East Indian copal," "Indian animé," and "Piney dammer;" in Hindí, according to the "Makhzan ul-adwiya," "chanderás;" and "kahruba" among the common folk. The author goes on to state, that an author, MUHAMAD BIN AHMAD BIN ZAKRIA says, there is a fountain in Central Hindústán which yields "sundras" in a liquid form; others, with the inhabitants of Malacca, say it is yielded by the camphor tree (dirakht káfúr). The English call the tree árpénirús (Juniperus family, *Thuja articulata ?*), and that "sundras" exudes from the tree in the day time, and camphor*

* ROYLE'S Illustrations, p. 352.

* Amber is called in Hindí "kapúr." I have no doubt on ac-

by night. I have seen four qualities of "sundras," one is yellow and red inside, and shining; another is pale yellow, and somewhat soft; a third is somewhat grayish and more or less opaque, and is found in huge rough masses: containing pieces of bark, dirt, &c., this is the inferior quality. A fourth quality is dark colored, light in weight. It is exclusively imported from Bombay, at which place there are to be found two kinds—one of which is the product of the *Vateria indica*, and comes from Travankúr and Mulabar, &c.; the other from Zanzibar and the mainland near. *Vateria indica* is the *Elæocarpus copaliferus* of Retz., and the *Chloroxylon dupada* of Buchanan.

The "animé" of *Hymenæa verucosa* and *H. courbaril*, is quite different from the present samples.

Good "sundras" is a clear amber colored resin. The finest pieces are sold as "kahruba" or amber, and amulets are often made of the resin to imitate amber.

The resin boiled with linseed oil yields a fine varnish, which is especially used by carriage builders. If boiled slightly, and only fine samples be used, it makes an excellent varnish for the painter in oils. If very clean specimens are dissolved in spirits, or even oil (linseed or poppy), a fine clear varnish for maps is the result. Papers to be varnished are, by the natives, first painted thinly over with a size made of rice and water; when this is dry the varnish is applied, and the size prevents it soaking through the paper to the other side.

It is not surprising that natives should have fallen into the error of considering "sundras" and amber the same things, since, at Zanzibar, whence the African "sundras" comes, the pieces of resin are actually found lightly imbedded in the soil. There are two kinds sold by the Zanzibar merchants—"zanaiti" and "chakázi."

Burton says, "that the true or ripe copal, properly called 'sandarúsi,' is the produce of vast extinct forests. The gum buried at depths beyond atmospheric influence, has, like amber and similar gum resins, been bituminized in all its purity."* This buried gum is found imbedded in a crumbling touchwood, which once was a solid tree. Dr. Royle says, that the African "sundras" (or a substitute for it) is produced by *Callitris quadrivalva* (*Thuja articulata*, Desf.)†

1613.—[ ]. Kahruba (real amber). Lahore bazar.

This is imported from Russia, Astrakhan, &c. The native druggists name Arús (Russia) and Balghar. No doubt a certain quantity comes this way, and goes to Yarkand, &c., from which district the hill people of Ladákh, Spiti, &c., obtain the amber beads, that are often to be met with among them.

1614.—[4100]. Mustagi-rúmí, or mustagi. Amritsar.

Called in Arabic, "'alk-baghdádi," and "arah;" also "mustáki."

(4112) Lahore.

A terebinthate resin. The real mustagi-rúmi is produced by the *Pistacia lentiscus* or *P. atlantica*. This grows on the shores of the Levant and parts of Greece, &c., and in the islands of the Greek Archipelago. From Scio, this resin was called by the Greeks, σχῖνος, as it is peculiarly abundant in that island. The tree seldom rises above 12 feet high; the leaves are abruptly pinnate, green above and pale beneath. Mastic, besides being a valuable source of varnish in the arts, is used as a masticatory (this word is derived from mastic), to preserve the teeth and sweeten the breath. As a medicine, Ainslie mentions, that it is prescribed by native doctors in conjunction with salep "misri." It is a tonic and hepatic. The resin occurs in small brittle tears of a pale yellow color: these tears get rubbed together in carriage and covered with a whitish powder like other resins. It is nearly inodorous until heated, and then it has a pleasant smell. The "mustagi" of the bazars is seldom if ever the Turkish mastic; but the species called *P. cabulica* and *P. khinjak*, grows all over Sindh, Bilúchistán and Kábul—from these places the resin is brought; as also pistachio nuts, khinjak fruit and the Bozgand dye stuff (mastic tree galls).

1615.—Sál resin, or rál.

The resin of the *Shorea robusta*, occurring in brittle stalactitic pieces, of a pale creamy yellow, nearly opaque. Each piece has a striated appearance, as if the resin had run out in thin liquid streams, which had coagulated on the surface, one over the other.

This is a common gum, and to be found in every bazar, and that of the same kind and appearance: it is chiefly imported, as the "sál" tree is not common. In Hushyarpúr and Jálandhar there are some sál jungles. (*Vide* "Woods".)

Dr. Birdwood observes, that the "rál" imported to Bombay from the Punjab is not similar to the "dammar" of the *Shorea robusta*, which he describes as transparent amber-colored, like *Vateria indica* gum. This point deserves attention, but the semi-opaque striated "rál," above described, is always accepted as *S. robusta*.

count of the confusion natives makes between the gum and the camphor tree and amber.

* "Lake Regions of Central Africa," II., 403-5, quoted by Dr. Birdwood, p. 267.

† Illustrations, p. 352.

BALSAMS.

1616.—[4110-4134]. Benzoin, lúbán. Two samples. Lahore.

These are of two qualities—one having a much whiter appearance—this is the best.

Gum benzoin, corruptly called Benjamin, is the produce of *Styrax benzoin* ; it is called "lúbán" or "úd-i-lúbán," also "dhúp" (incense). The name "lúbán" is not to be confused with the "labbán," which is the Arabic name of olibanum. Benzoin is sold in somewhat brittle agglomerated pieces, which are amygdaloid in structure, and mixed white and brown. It burns with a pleasing fragrance. The best varieties however are almost entirely whitish with a pink cast, retaining their amygdaloid form. The constituents of benzoin in 100 parts, are, as obtained by BRANDE :—

Benzoic acid, ...	9·0
Acidulated water, ...	5·5
Empyreumatic oil, &c., ...	60·0
Charcoal, ...	22·0
A mixture of carburetted hydrogen and carbonic acid, ...	3·3

This fragrant resin is entirely imported. It is produced in Sumatra and exported from Acheen ;* but grows also in Prince of Wales' Island, &c., and there are plants in the Botanic Garden at Calcutta. It is given by native doctors in asthma : and the vapour of the burning gum locally applied to hœmorrhoids.

1617.—[ ]. Khún siáwashán ; híráda khún ; dam-ul-akhwain. Dragon's blood. Lahore bazar.

This is a resin tinctorial, which, when ground up, gives a fine transparent red. It is, however, inferior to the lac lakes and madder lakes of the artists' colormen. It is sold in fragments of a dark red color —hence its name of dragon's blood. It is enumerated among the drugs in the Bagdád bazar, where it is said to come from India. It is the produce of *Pterocarpus draco* or *P. indica* (Willd.), and not the *Dracæna draco*, which is peculiar to the Island of Teneriffe. NIEHBUHR mentions a tree (probably *Pterocarpus*) in the province of Haidramát in Arabia Felix, as producing dragon's blood ; and AINSLIE refers this to the *Calamus draco*, and says, the dragon's blood of the Indian bazars is derived from Java, and Islands in the Indian Archipelago.

The following is a list of gums, sent from Madras by the Agri-Horticultural Society. Many of them are derived from trees which are not known in these parts, but at the same time several others are found in our hills, and therefore their gums may be met with.

* AINSLIE, Mat. Med., I., p. 33.

While nearly all the Punjab gums are remarkably pale in color, and hardly one, except the kino (*Butea frondosa*) is dark-colored ; it is remarkable to notice the fine deep reds, browns and black colors of the Madras gums, there being hardly one white sample among them. The list is as follows. The botanical names given here are those marked on the original papers containing the specimens, and are on the authority of the writer of those papers.

Ním tree gum—*Azadirachta indica*—Brownish gum, much mixed with impurities.

Gum of *Pongamia glabra*—a thick black untransparent exudation.

Gum of *Anacardium semecarpus*—the marking nut tree—a black gum.

Gum of *Diospyros embryopteris*—in black nodules, with wrinkled surface.

Gum of *Borassus flabelliformis*—black ; fracture black and shining.

Gum of *Calophyllum inophyllum*—(Alexandria laurel)—black.

Gum of *Terminalia tomentosa*—red gum, black outside the pieces.

Gum of *Acacia lebbek*—an amber brown gum.

Gum of *A. arabica*—a dark colored gum, much mixed with bark and with impurities.

Gum of *Ailanthus excelsis*—a red gum, black outside.

Gum of *Spondias mangifera*—a red gum, black outside.

Gum of *Nerium suaveolens*—dull red gum.

Gum of *Barleria prionitis.*

Gum of *Pterocarpus marsupium*—Malabar kino.

Gum of *Odina wodier*—dark red gum.

Gum of *Melia sempervirens* (Bukhain)—looks like "mochras."

Gum of *Eriodendron anfractuosum*—black and untransparent, looks more like a gall than a gum.

Gum of *Poongallee* (*Gyrocarpus Jacquini?*)—black, like dried tar.

Gum of *Tricosanthes cucumerina.*

Gum of *Moringa pterygosperma*—very dark colored.

Lákh, from bér tree. This is the lákh of Mysore and Southern India, and is very superior to Punjab lákh. The great thickness and uniform continuance of the crust is remarkable.

Gum of *Careya arborea*—greenish gum.

Gum of *Feronia elephantum*—clear yellow gum, soluble in water.

Gum of *Thespesia populinea*—a red gum.

Gum of *Ponciana alata.*

Gutta percha from *Euphorbia.*

Gutta percha from *C. gigantea*—madár.

REPORT ON GUMS AND RESINS.

CLASS IV.—SUB-CLASS (A).

THE JURY WAS COMPOSED OF THE FOLLOWING GENTLEMEN :—

MR. R. H. DAVIES,	DR. F. ELTON,
MR. R. EGERTON,	MUNSHI HARSUKH RAI,
MR. F. E. GORDON,	SIRDAR JASSA SINGH, *of Amritsar.*
DR. B. BROWN,	

REPORTER—MR. B. POWELL.

THE collection consists of (1st) a series of genuine gums, soluble in water, which are all the produce of the Punjab. The use of the first division is principally in the arts, although a few are astringents, and others useful as a mucilaginous vehicle in medicine.

2nd. Gum resins, soluble in spirits of wine, which are almost without exception imported; one or two of them, such as mastic and "gúgal," or Indian Bdellium, are the produce of the Sindh and Bilúchistán Hills; one or two of these again are found to the north of these countries, such as assafœtida, in Kandahár and Herát; some more, as "jaushír" *(Opoponax)* and *Sagapenum*, are produced in Khurasán and Persia proper; while the remainder are brought from the provinces of Arabia and Africa, by means of the ports of the Persian Gulf to Bombay, whence they are distributed over the Punjab. One of this class, gamboge, comes wholly from southern latitudes of Siam and Cambodia, being imported *vià* Calcutta; and the dragon's blood, it is not certain whether the *Pterocarpus* producing it is an inhabitant of Arabia Felix, or whether it comes from the Indian Archipelago.

The use of this class of gum resins is principally in medicine; while the fragrant odours which some of them yield when burnt, have rendered them famous from antiquity, as used in heathen temple worship for incense. The aromatic properties and bitterness of others, as myrrh, have rendered them valuable as antiseptics; and the ancients used them in embalming the dead.

The third division consists of resins, including balsams, which are distinguished from all other resins and gum resins, by containing benzoic acid.

The genuine resins are principally the produce of the pines of the Kohistán—the "chíl" *(Pinus longifolia)*, the deodar *(Cedrus deodara)*, and some others.

These yield a semi-viscous resinous substance, which, on distillation, yields turpentine; and if the process be stopped when the turpentine has passed over, the residue will be a clear brown and red resin. If the distillation is carried on still further, a blackish liquid, which DR. URE calls "balsam of turpentine" passes over; the ultimate residue is black resin, or "colophony" (chíloṅ).

The deodar yields a kind of wood-oil, of a dark color and strong smell, which is highly

antiseptic, and is used in preparing inflated skins for river use, and to preserve timber from insects.

The chips of wood from both these conifers, yield, by dry distillation, an excellent tar.

One very important resin, the Indian copal, reaches us both by Calcutta and Bombay. The "sál" resin also comes from Hindústán, and benzoin is imported by Calcutta, sometimes also by Bombay, from Sumatra and the Archipelago.

The wood-varnishes, liquid balsams, such as tolu, copaiba, and "liquid-ambars," are unrepresented.

It is not to be wondered at, that the number of indigenous gums in the Punjab should be small, as compared with the products of Southern and Central India. We have only to compare the tropical forests of the one, abounding in almost endless varieties of vegetable forms with the level plains of the Punjab, scantily wooded, and producing almost the same forms over the whole province, to infer such a conclusion.

It is only when we ascend the hills that the luxuriance of vegetable life opens out around us; and even here, the luxuriance does not exhibit itself in a larger production of gummifers. Nor is it possible to ignore the effect of climate in promoting exudations from many trees that are by nature gummifers, and yet yield abundantly in one country, and never in another. In the Madras list are to be found the gums of many trees not unknown in the regions of the Himálaya, and some even in the Plains, such as *Azadirachta indica, Pongamia glabra, Calophyllum, Terminalia tomentosa, Spondias, Nerium, Melia, Careya, Feronia,* and others; and yet there is not a specimen in the collections of the gums of any one of these. No doubt a more careful examination of trees in portions of the hills would lead to the extension of our series, but this want of research is not wholly sufficient to account for the difference.

The Jury, however, would suggest, that against the occurrence of another Exhibition, residents in, and visitors to, the hills, interested in economic botany, should extend their search and enquiry for new or unnoticed gums and resins; and that a handsome prize should be offered for the best collection of such uncommon gums.

Before leaving this subject, the Jury desire to record their sense of the value and interest attaching to the carefully named collection of gums from the Madras Presidency, both as inciting to the enquiries just alluded to, and as serving for the purposes of illustration and comparison.

Before entering on a consideration of the individual samples exhibited, the Jury present to notice a comparative list of the collection of gums indigenous to the province, arranged as products of hill or plain districts.

Plains.	Hills.
Gum of *Acacia arabica*—babúl.	*Odina wodier*—jingan, kaimal.
" *A. vera*—kíkar.	*Bombax heptaphyllum*—sembal (mochras).
" *Vachellia Farnesiana*—choti kíkar.	*Conocarpus latifolius*—dhao or dhoń.
" *Acacia odoratissima*—siris.	*Acacia catechu*—kherí or khair.
" *A. modesta*—phuláhi or bimbri.	*Armeniaca vulgaris*—shaftálú.
" *Tamarix indica*—vadhál.	*Cochlospermum gossypium*—katíra (?)
" *Prunus alucha*—alúcha.	Resin of *Pinus longifolia*—chíl.
" *Amygdalus persica*—árú.	" *Cedrus deodara*, kelu.
" *Butea frondosa*—dhák	And other conifers.
" *Mangifera indica*—ám.	*Sapindus acuminatus*—dodan.

PLAINS.	HILLS.
Gum of *Moringa pterygosperma*—mochras; sohájna.	*Artocarpus integrifolia*—dhárá.
„ *Prosopis spicigera*—jhand.	*Spondias mangifera*—ambárá.
	Albizzia odoratissima—kurmrá.
	Cerasus puddum—pajjá.
Perhaps "sál" resin (*Shorea robusta*) might be added, as there are thickets of "sál" in the Jálandhar Doab.	

The Jury remarked the following specimens in the collection as being worthy of notice.

Gum Arabic.—The samples vary in color from white to brown. Some very excellent samples consist of a mixture of white, yellow and reddish pieces. The majority of samples are, however, not well picked, and contain much bark and other foreign matters. The gums sold as Arabic are probably the produce of any or all of the species of *Acacia* that are commonest in the district whence the sample comes; but there is not that great variety described as noticed in some samples of gum arabic in the English Exhibitions of 1851 and 1862, where one sample of Arabic was said to be a mixture of twenty-four gums, and to contain the gum of *Feronia elephantum, Acacia catechu*, and many others. The native doctors use gum arabic as a tonic, and distinguish between the red pieces and the white, which are said to exude at different seasons of the year.

Some specimens of the gum arabic are in highly friable nodules: this is said to be caused by rain falling on the tears of gum after they have exuded from the tree, which moistens them, after which they are immediately dried again by sun and wind.

Gum arabic is much used as a mucilage in European medicines; but the hospitals and dispensaries of the Punjab are still mostly supplied from Calcutta. As arabic of excellent quality can be produced by the Punjab districts, there is no reason why the gum should not be supplied here.

The points that need attention are, careful picking of the gum, so as to avoid mixing it with pieces of dirt, &c., &c.; and then the gum should be sorted into first, second, and third qualities.

The best sample of gum arabic was that from Dera Ghází Khán (4167), being clean, well picked, and in pieces of an uniform size. The Jury award to this sample a Prize of Rs. 20. The sample from Delhi is also very good, being uniform in color and free from dirt.

There is also a fair sample from Sirsa, with information on the box lid to the effect, that the gum is collected in March and April, that it is much used in the manufacture of sweetmeats, and is exported eastward.

A coarse kind of arabic, or more probably "siris" gum, of a deep amber color, is called "lora" and used by calico printers, who stamp the fabrics with patterns in gold and silver leaf, and which adhere by the aid of mucilage. "Siris" gum is not soluble entirely, but softens into a jelly-like size.

The gum of the *A. modesta*, "phúlah," is in little curled pieces, quite soluble and of a yellow color.

There is a curious gum exhibited from Hushyarpúr, called "kaimal" (*Odina wodier*). The sample is a pale brown color, in a large cylinder, hollow at the centre, and the gum forming in a radiated structure, much more dense outside than in; it has a sour taste, like paste that has turned sour; is pale brown color, and is soluble. It is used to mix with whitewash and plaster. There is no other sample like it. The piece exhibited is evidently

artificially formed by dissolving the crude gum, and allowing it to evaporate and recoagulate in its present form. There is also a piece of brownish gum adhering to the bark of the tree, and called "kamal," exhibited from Jhilam.

There was one sample of white gum of the *Conocarpus latifolius*—it came from Kangra.

There is also one sample of a white gum from the mango tree, sent by the Delhi Committee.

A fine sample of white stalactitic pieces of the gum of *Odina wodier* is sent down from the Simla hills. This sample merits special mention.

There are several samples of "sohájna," gum of *Moringa pterygospermum*, these are frequently called mochras—a name also given to the gum of *Bombax heptaphyllum* (sembal), and to the imported galls of the areca palm, also called "phúl supyárí."

Most samples of "sohájna" are of a dark color, but containing some pieces of a pale waxen rose pink; the latter pieces are the best. The Jhilam samples contains, besides the pink sort, some pieces that are very nearly white.

There are several specimens of the East Indian kino, or "kamarkas," produced by the *Butea frondosa*, or "dhák" tree. The gum occurs in little fragments of a ruby red, which turn black and opaque by keeping. This gum is a powerful astringent, and would be valuable in tanning leather, except that it imparts its color to the hides, and spoils them. In native medicines, it is eaten as a medicine with ghí and sugar, and supposed to strengthen the liver and loins, and to be tonic and aphrodisiac, whence its name of "kamarkas." On account of its astringent properties it is used in European medicine.

The finest sample was sent from Gurgaon (4053), and to it the Jury award a Prize of Rs. 10. The Gujrát sample was also clean and good.

GUM RESINS.

None of these are produced in the Punjab but are imported. Ammoniacum, "ushak, jaushír" (*Opoponax*) and assafœtida, all referred to species of Umbelliferæ, are commonly met with in the bazar; but it is absolutely impossible to get genuine "sakbinaj"* (*Sagapenum*), except here and there a fragment at a very high price. The samples exhibited are all "jaushír," which is commoner. Ammoniacum is the cheapest of all. Galbanum (bárzad and baríja) is not to be obtained. The reporter endeavored at Amritsar to get a sample, but without success; various samples of resin (baroza or baríja) are always sold in its place. The particulars of these gums are given in the preceding pages, and so are not repeated here. The five gums—"Ushak," "jaushír," "sakbinaj," "bárzad" and "farfeyún," are classed together by native doctors as remedies for rheumatism. Some of them become viscous after long trituration, and the druggists submit them to this previously, as they suppose it brings out the virtue.

The sample of "gúgal" from Amritsar, in this series, is remarkable fine and pure.

RESINS.

A fine sample of "sál" resin (*Shorea robusta*) is sent from Gurgaon, in nearly opaque pale yellow striated stalactitic pieces.

There are several specimens of the semi-viscous whitish "gunda baroza," or crude turpentine of the "chíl" (*Pinus longifolia*).

* A sample exhibited with the name of "sakbinaj," from Amritsar is quite another substance. It is a black resin, containing fragments of impurities, and little greenish tears, here and there interspersed: it had a bitter taste and a slightly alliaceous smell. It might have been the resin of an *Amyris balsamodendron*; but was certainly not Umbelliferous.

Dera Ismail Khán exhibits a very fine sample of pale resin (4161); to this the Jury award a Certificate of Merit. This resin is however, prepared by an exceedingly wasteful method. The crude turpentine is heated slowly in an open vessel, and hence the spirit of turpentine, which is the most valuable product, is allowed to fly off in vapour! Such an error is very easily rectified by performing the process in a closed still. There is also a fine sample of black resin, or "colophony," prepared at the Sealkot Mission Industrial School. This sample is accompanied by some very excellent pure spirit of turpentine, which is distilled from the ordinary "gụnda baroza," and the "colophony" is the resulting residue after distillation. The Jury recommend that for this sample, together with pure turpentine, which is first-rate, a Silver Medal and Certificate be awarded.

There are several samples of East Indian copal, or "animé." These are all invaluable in the arts, as furnishing a varnish for the carriage builder and the cabinet-maker, while if the white varieties be selected, and white poppy oil be used with it, a clear and colorless varnish for maps is obtained. On sending to Amritsar for various qualities of this resin, about six were obtained. The first being a clear and beautifully transparent resin, perfectly clean and of a very pale whitish yellow; the next amber-colored; a third clean, but clouded and horn-like as to transparency; a fourth was a little much worn and rubbed pieces of a brown color; a fifth was really black, but, as I believe, really a *Coniferous* resin; and a sixth was exactly like amber. I have little doubt, that the first four are of Indian origin, from *Vateria indica;* and that the last was African "animé" from Zanzibar; where, according to Burton, it is found loosely imbedded in the surface soil of the thickets where the trees grow, thus commencing to go through the process that genuine amber has already passed though ages ago; and this accounts for the similarity. This kind of copal is constantly passed off as real amber by native salesmen, and called "kahruba."

BADEN POWELL,

Reporter to the Jury.

SUB-CLASS (B). OILS AND COMPOUNDS OBTAINED FROM OIL, INCLUDING OIL SEEDS.

This Sub-class includes—

1st. Burning, lubricating, and esculent oils.

2nd. Fragrant oils and attars, and medicinal oils.

3rd. Oil compounds, as soap, &c.

Along with Nos. 1 and 2, are included the seeds, &c., yielding the oils.

The importance of oil in this country cannot be over-estimated, and the consumption of it is something wonderful. It is largely used in cooking; for as the principal nourishment of the great majority of the population is vegetable, carbonaceous substances, such as oil and ghí are requisite for mixture: besides this, oil is used by many natives, who rub it over their bodies; and the use of oil for lighting purposes is too obvious to need mention. If the consumption of oil is stated as 1 oz. per diem for nearly every man, woman and child in the province, we have a daily consumption of oil amounting to more than 10 millions of ounces.*

The following table from Jálandhar district, will show the cost and value of the most common oils :—

Description.	Produce per acre.	Yield of oil per 1 md.	Cost.	Value.
	MDS.	SEERS.	R. A. P.	RS.
Táramíra, ...	2	13	1 3 0	2
Sesamum, ...	2	16	2 10 0	6
Sarsoṅ, grown after maize, múng, &c.,	4	13	2 11 0	8
Linseed, ...	3	16	5 0 0	6

* The total population of the Punjab in 1865, was 12,717,210, so that 10 millions is within the mark.

And as to the proportion produced in Gujrát, it is stated that—

Sarsoṅ yields	¼ of its weight in oil.	
Til (*Sesamum*),	⅓	"
Táramíra,	¼	"
Kussumba (*Carthamus*),	⅕	"

1618.—Tel sarsoṅ, or kharwá tel, or raughan siya, mustard oil and rape seed oil.

There are four varieties—which will be catalogued *seriatim*—all species of mustard.

1st. The "sarsoṅ," "sarhoṅ" or "sarshaf," rape seed oil (*S. juncea*).

2nd. "Rai," mustard. (See *S. campestris.*)

3rd. "Torya."

4th. "Táramíra" (*S. eruca*).

"Sarsoṅ" seed was exhibited from the following districts—

(2552) Delhi (black).
(2569) Gurgaon.
(2603) Hissar.
(2679) Ambálah.
(2696) Ludhiana.
(2719-2720) Simla.
(2770) Mahlog.
(2832) Jálandhar.
(3859-3055) Kangra (black).
(2892) Kangra (variety).
(2975) Kangra (red).
(3148) Lahore.
(3198) Rawalpindi.
(3226) Rawalpindi (black).
(3247) Jhilam.
(3271) Bhera of Shahpúr.
(3298) Gugaira.
(3352) Muzaffargarh.
(3376) Dera Ismaíl Khán.
(3463) Hazara.
(3480) Kapúrthalla.
(3503) Srínagar.
(3504-05) Srínagar (variety).

From Sirsa district it is noted that "sarsoń" yields one-third of its quantity in oil. In Rohtak "sarsoń" is sown in ridges between the fields of wheat and barley. The cost is from $4\frac{1}{2}$ to $4\frac{1}{4}$ seers per rupee, but varies considerably; export is both in the direction of Bengal and Káráchí.

In Major Clarke's "Agriculture of the Rechna Doab," the cost of cultivating "sarsoń" (one acre) is thus given:—

Produce.	R.	A.	P.	Cost.	R.	A.	P.
8 maunds,	8	0	0	Government revenue, ...	2	0	0
				Lumberdarí, &c.,	0	4	3
				Seed, 5 seers, ...	0	3	0
				Reaper, 1 maund 8 seers, ...	1	3	3
				Sweeper, 20 seers,	0	8	0
				Potter, Carpenter, Dhurwaie and Blacksmith, 3 seers each; Dharmsala, $1\frac{1}{4}$ seer,	0	5	6
				Total expenses, ...	4	8	0
Total, ...	8	0	0	Total gross profits, ...	3	8	0

"Sarsoń" or "sarhoń" oil, rape seed, is the cheapest and commonest kind of oil. When kept it has a disagreeable rank nitrogenous odor, but is capable of purification by agitation in a leaden vessel, or better still by agitation with sulphuric acid and water. The "khal," or oil cake, after expression of oil, is given to fatten cattle.

Samples were further sent from—

Jálandhar.
Kangra (two varieties, white and black seed).
Hushyárpúr.
Amritsar.
Gujranwalla.
Gujrát.
Jhilam.
Shahpúr.
Gugaira.
Dera Ghází Khán.
Jhind.

A sample of mustard seed grown at Spití is also sent. The oil is extracted by pressing the seed in a cloth: the "sarsoń" is there called "nawár."

1619.—Mustard, rai (*Sinapis alba et nigra; S. campestris.*

The seed is of two colors, black and white. Exhibited from—

(2570) Gurgaon.
(2621) Rohtak.
(2858) Kangra.
(2918) Hushyarpúr.
(3057) Gurdaspúr.
(3129) Lahore (black).
(3130) Lahore (white).
(3227) Gujrát.
(3299) Gugaira.
(3414) Dera Ghází Khán (white).
(3415-3418) Dera Ghází Khán (black).
(3500) Jammú.
(3556) Nábha.
(2551) Delhi (white).
(2860) Kangra (white).
(2974) Amritsar (white).
(3225) Gujrát.

Mustard oil was sent from—Rohtak, Sirsa, Kangra, Amritsar, Lahore, Gugaira, Dera Ghází Khan, and Jhind.

1620.—Tárámíra (*Sinapis eruca*).

A kind of mustard with a red seed, somewhat elongate. The oil it produces is used as food and for burning, and as a medicine for cattle and horses. It is called "assu" in Punjabí.

(3131) Lahore.
(3188) Gujranwalla.
(3230) Gujrát.
(3249) Jhilam.
(3268) Shahpúr.
(3354) Muzaffargarh.
(3366) Dera Ismail Khán.
(3417) Dera Ghází Khán.
(3483) Kapúrthalla.
(2555) Delhi.
(2568) Gurgaon.
(2829) Jálandhar.
(2922) Hushyarpúr.
(2976) Amritsar.
(3061) Gurdaspúr.

Oil of this seed was exhibited from Jálandhar, Amritsar, Lahore, Gujrát and Jhínd.

1621.—"Torya" seed, a variety of mustard, was exhibited from—

(2681) Ambálah.
(3156) Lahore.
(3484) Kapúrthalla.
Its oil is hardly distinguishable from mustard or rape seed oil.

1622.—[2555]. Tarah. Delhi.

Also an oil seed of this class.
(2568) Gurgaon.

1623.—Sesamum *(Sesamum orientale). Vern.*—Til.

This plant is being generally cultivated, and often sown round the edges of fields, forming as it were a green hedge to the main crop. It yields a useful oil, which has none of the bad nitrogenous odour of mustard oil; for this reason it is the oil which is employed for burning in all European houses. The seed as it comes from the plant is brown or black, and is called in that state "til siyah;" but it is blanched by warming in hot water, the outer skin of the seed rubbed of, and then the seed is white, and called "til safed." This sells at a higher price, and produces the purest oil. The yield of oil is about two-fifths the weight of seed employed. There is scarce a district in the plains and lower hills that does not produce this seed.

It was exhibited from the following districts:—
(2553-54) Delhi (washed and black).
(2604) Hissar.
(2645) Sirsa.
(2721) Bhajjí, Simla States.
(2757) Kothar, do.
(2769) Mahlog, do.
(2806) Balsán, do.
(2830) Jálandhar.
(2861) Kangra.
(2921) Hushyarpúr.
(2966-67) Amritsar.
(3133-34) Lahore.
(3189) Gujranwalla.
(3196-97) Rawalpindi.
(3228-29) Gujrát.
(3270) Shahpúr.
(3297) Gugaira.
(3353) Muzaffargarh.
(3482) Kapúrthalla.
(3517) Srínagar.
(3535) Nábha.
Dera Ismail Khán.

The oil was also sent from Rohtak, Sirsa, Jálandhar, Hushyarpúr, Amritsar, Lahore (two samples), Gujrát, Jhilam, Shahpúr, Gugaira, Dera Ghází Khán and Jhind.

In Sirsa the yield of oil is 16 seers for a maund of seed: it sells at 4 to 4½ seers per rupee, and is exported both towards Bengal and Kárachí.

1624.—Linseed oil *(Linum usitatissimum, L.) Vern.*—Alsi; katán (Arabic); kéúñ (Kashmírí).

This seed is extensively cultivated in the Punjab: the native flax produces abundance of seed for oil, while its fibre is inferior; the European seed on the other hand is better for fibre than for oil.

In Kangra it is thrown in among the stubble after cutting the rice crop, and then springs up without any cultivation.

The native seed is smaller, not so long, and of a redder color, than European seed.

The seed is first bruised and then pressed; it yields one-third the weight of seed in oil.

This oil is invaluable for painting purposes; if boiled down to half its bulk, it forms a good drying oil, and is used to make printers' ink. This oil is also boiled with copal (sundras), and forms a first-class varnish.

(2678) Ambálah.
(2831) Jálandhar.
(2862) Kangra.
(2920) Hushyarpúr.
(2973) Amritsar.
(3060) Gurdaspúr.
(3187) Gujranwalla.
(3199) Rawalpindi.
(3224) Gujrát.
(3216) Jhilam.
(3269) Shahpúr.
(3355) Muzaffargarh.
(3375) Dera Ismail Khán.
(3482) Kapúrthalla.
(3485) Jammú.
(3486) Ditto from Srínagar (called kéúñ).
(3554) Nábha.

Samples of the oil were sent from Jálandhar, Kangra, Amritsar, Lahore, Gujrát, Jhilam, Shahpúr and Dera Ghází Khán.

The following is from DR. ROYLE:—

"Linseed, or the seeds of the flax plant, are oval, pointed in shape, compressed, with a sharp margin; brownish colored, smooth, and shining on the outside, but white internally, and without odor. The outside has a bland, mucilaginous taste, in consequence of the skin of the seed being covered with condensed mucus. The white part, or almond of the seed, has an oily taste, from containing fixed oil, which is separated by expression.

"These seeds, analysed by MEYER, consist, in one

hundred parts, of 15·12 mucilage (nitrogenous mucilage with acetic acid and salts, according to some) chiefly in the seed-coat; 11·26 fatty oil in the nucleus; in the husk, emulsion, 44·38; besides wax, 0·14; acrid soft resin, 2·48; starch with salts, 1·48; in the nucleus besides the oil, gum, 6·15; albumen, 2·78; gluten, 2·93; also resinous coloring matter, 0·55; yellow extractive with tannin and salts (nitre and the chlorides of potassium and calcium), 1·91; sweet extractive with malic acid; and some salts, 10·88.

"The condensed mucus, which abounds in the testa of the seed, is readily acted on by hot water, and a viscid mucilaginous fluid is formed, in which are two distinct substances; one completely soluble in water, analogous to common gum, called Arabine by chemists; the other portion is merely suspended, and is considered to be analogous to the Bassorine, found chiefly in gum Bussoora, and in cherry-tree gum. Alcohol produces a white flaky, and acetate of lead, a dense precipitate in mucilage of linseed.

"Linseed oil, which we have seen, is contained in the kernel of the seeds, is obtained by expression, and may be either cold-drawn, or, as usually obtained, after the seeds have been subjected to a heat of 200°. The former, as in the case of cold-drawn castor oil, is paler, with less color and taste than linseed oil prepared with the aid of heat. This is of a deep yellow or brownish color, of a disagreeable smell and taste; specific gravity 0·932, soluble in alcohol and ether; differing from many other fatty oils, especially in its property of drying into a hard transparent varnish—a peculiarity which is increased by boiling the oil, either alone, or with some of the preparations of lead.

"The yield of oil from a bushel of East Indian seed is 14¾lbs. to 16 lbs.; of Egyptian, 15 lbs.; of Sicilian, 14½ to 15½ lbs.; of Russian, 11 lbs. to 13 lbs.; of English or Irish, 10¾ lbs. to 12 lbs.

"Linseed oil, according to Sace, is composed of Margarine and Oleine in nearly equal proportions. But the oleic acid of linseed differs from that of other fatty bodies. The anhydrous acid is composed of carbon, 46; hydrogen, 38; oxygen, 5. The margaric acid is as usual composed of carbon, 34; hydrogen, 33; oxygen, 3. The glycerine obtainable from linseed oil in large quantities, is also similar to that procured from other fats.

"The seeds, after having had the oil expressed from them, are in the form of a flat mass, commonly called oil-cake. This being reduced to coarse powder, forms the linseed meal which is so commonly employed for making poultices, though these are also formed of the simply powdered seeds. Here, it is evident, from the internal oleaginous and external mucilaginous parts being all ground together, and their properties elicited by hot water, an admirable mixture is produced for making a readily made emollient poultice. From the chemical composition, it is also evident how nourishing the linseed is likely to be, and, indeed, from experience is well known to be, for fattening cattle."

1625.—Castor oil (*Ricinus communis*). *Vern.* — Arind ka tél; harind; bedanjír (Pers.); harnauli (the seed).

The native method of preparing the oil is very defective, always resulting in a thick semi-transparent oil, or else of a dark thick oil worse than the first: it is prepared either by simply pressing the seeds, or else by roughly bruising them, and then boiling in water, which latter process gives a purer oil. Sometimes the nuts are partially roasted over a charcoal fire, and then bruised—this often discolors the oil.

The oil is good for burning; but is chiefly valued as a safe and efficient purgative. The pulp of the crushed seeds is applied locally as a poultice in dracunculus (guinea worm). Samples were sent from—

(2550) Delhi.
(2623) Sirsa.
(2684) Ambálah.
(2863) Kangra (this is a remarkably small variety).
(2925) Hushyarpúr.
(2926) Amritsar.
(3150) Lahore.
(3195) Rawalpindi.
(3223) Gujrát.
(3302) Gugaira.

There are two methods in use for extracting the oil from the seeds—1st, by pressure, which is the ordinary method; and 2ndly, by bruising the seeds, and afterwards boiling them in water. The oil floats on the surface, and is skimmed off. This method is employed when a purer oil is required.

The oil is only exhibited from Kangra, Amritsar, Gujrát and Lahore; which latter place exhibited for comparison a sample of European cold-drawn castor oil.

1626.—Poppy oil, khashkásh.

There are two varieties of seed—white and "black" (or rather blue-gray color)—they yield an oil precisely similar. This oil is singularly clear. When fresh it is like olive oil, which it is largely used to adulterate in Europe. It is an excellent drying oil for the painter, and possesses the remarkable property of becoming colorless by simply exposing it for some days to the sunlight. The oil is obtained by pressure. The seed is sent from—

(2683) Ambálah.
(2866-2868) Kangra.
(2919) Hushyarpúr.
(3010) Amritsar (black).
(3111) Amritsar (white).

(3135) Chúniáñ, Lahore district (of two colors).
(3231) Gujrát (white).
(3232) Gujrát (black).
(3300) Gugaira.
(3373) Dera Ismaíl Khán.
(3498) Srínagar.
(3499) Jammú (of the 2nd kind).
Samples of poppy oil were exhibited from Kangra, Amritsar, Lahore, Shahpúr and Dera Gházi Khán.

1627.—Kussumbha, safflower seed oil. *Vern.*—Poliyán (wild variety) ; karar ; ma'susir (Pers.) ; the bastard saffron or safflower (*Carthamus tinctorius*).

There are two seeds—one the cultivated, is white and glossy ; the other (karar) is a smaller but similarly shaped seed, mottled or dusted, brown-gray and white ; both yield oil. The oil is clear yellow ; is esculent: and would be peculiarly suitable for burning in lamps, on account of the little heat which it gives out. It deserves to be more generally cultivated than it is. The flower yields the well known dye. (*See* Sub-class (C)., Dyes).
Samples of the seed were sent from—
(2556) Delhi.
(2565) Gurgaon.
(3051) Amritsar.
(3145) Lahore.
(3200) Rawalpindi.
(3733) Gujrát (karar).
(2680) Ambálah.
(3144) Lahore.
The oil was exhibited from Kangra, Hushyarpúr, Amritsar, Lahore, Gujrát and Jhind.

1628.—[4240]. Oil of almonds, (*Amygdalus vulgaris*). *Vern.*—Raughan-i-bádám. Lahore.

A sample is also sent from Amritsar (4212), and Dera Gházi Khán (4410).
This is an expensive article, selling as high as 13 Rs. a seer. It is expressed only in small quantities by means of a small screw press, and is used in medicine.
The almonds are imported from the Persian Gulf. There is also the oil of bitter almonds, "raughan-badam-talkh," used exclusively in medicine.

1629.—[ ]. Oil of apricot kernels, "raughan-i-maghz-i-khubáni."

This is principally a hill produce near Simla, and near Kanawár, as also near Kangra. The kernels and stones of the apricot form an article of export to the plains, under the name of "sarí."
Samples of the stones are ent both from Kangra and from Simla, and the oil (4181) Simla and (4193) Kangra. A clear amber yellow oil. In Lahore this oil is used. Principally being imported from Kúlú, but none is produced in Lahaul ; also mustard and poppy oil are occasionally brought in.

1630.—[4196]. Walnut oil, "raughan-i-akhrot." Kangra.

A clear serviceable oil of a pale yellow color.

1631.—[ ]. "Baikar," oil of *Prinsepia utilis.* Kangra.

This is the only specimen exhibited.

1632.—[4190]. Mowa oil and kernels. Kangra.

The oil of the kernels of *Bassia latifolia.*
"The seeds yield by expression a large quantity of concrete oil, which is used in lamps, to adulterate ghi, for frying cakes, &c. The kernels are easily extracted from the smooth chesnut colored pericarps when they are bruised, rubbed, and subjected to a moderate pressure. The oil concretes immediately it is expressed, and retains its consistency at the temperature of 95°. The oil is however thick and coarse, and only used by the poorer classes.
"It is said that the flowers are eaten fresh as a vegetable, and that an ardent spirit is distilled from them.
"In Gujrát and Rájputána every village has its spirit shop for the sale of the distilled liquor from the flowers. In the island of Caranja, opposite to Bombay, the Government duty on the spirit distilled (chiefly from this flower) amounts to at least £60,000 per annum ; I rather think that £80,000 is most generally the sum."*
In Kangra district, the following particulars are recorded by BARNES, in his Settlement Report.†
"The 'mowa' or *Bassia longifolia,* is widely diffused over the lower hills. In parts of perganah Núrpúr it exists in great abundance, and the two small taloquas of upper and lower Mow, derive their name from the prevalence of the tree. It is well known in our lower provinces. A spiritous liquor is drawn by distillation from its flowers ; and a thick oil, adapted for the manufacture of candles, is expressed from the seed. The flowers are collected as they fall from the tree, in May, and are sold by

* DRURY'S "Useful Plants of India."
† Kangra District, para. 149.

the people to the "kulál" or distiller, at the rate of fifty seers for the rupee. The flowers are immersed in water. The fourth day they are fermented and the process of distillation begins. The people burn the oil for lamps, and traders sometimes use it to adulterate the ghí (or clarified butter) intended for exportation."

1633.—Butter from the *Bassia Butyracea* of Kamaon. DR. W. JAMESON.

Together with a sample of the seed producing this vegetable tallow. The butter itself is in little round pieces, quite white, smooth and firm: it becomes quite liquid by warming. MAJOR DRURY describes it thus:—"DR. ROXBURGH has fully described in the 8th Vol. of the 'Asiatic Researches.' The kernels of the fruit are bruised into the consistence of cream, which is then put into a cloth bag with a moderate weight laid upon it, and left to stand till the oil or fat is expressed, which becomes immediately of the consistence of hog's lard, and is of a delicate white color. Its uses in medicine, are much esteemed in rheumatism and contractions of the limbs. The pulp of the fruit is eatable. The juice is extracted from the flowers and made into sugar by the natives. It is sold in the Calcutta bazar, and has all the appearance of date sugar, to which it is equal if not superior in quality. The butter which is obtained from the kernels of the fruit is reckoned a valuable preservative when applied to the hair, mixed with sweet scented oil, and thus sold and exported." A sample was sent to England for analysis, and was found to consist of 34 of fluid oil, and 6 parts of vegetable impurities.* The original specimen dissolved readily in warm alcohol, a property which may render it of great advantage in medicinal purposes. It makes excellent soap. When pure it burns bright without smoke or smell, and might be advantageously employed in making candles.

It is a peculiar characteristic of the seeds of the *Bassia* trees, that they contain at the same time saccharine matter, spirit and oil, fit both for food and burning in lamps. The butter procured from this species of *Bassia* is not liable to become rancid, even if kept for some time. It is completely melted at a temperature of 120°, but retains its consistency up to 95°.

The tree is abundant in the Almorah hills, where the butter is called "palwa" or "phalwara." It flowers in January, and the fruit ripens in August. The butter is highly esteemed as a linament in rheumatism, contraction of the limbs; and is an excellent emollient for chapped hands, &c., &c., during the winter months.

* ROYLE'S Illustrations, p. 263.

1634.—[ ]. Vegetable tallow (*Stillingia sebifera*). Kamaon. DR. W. JAMESON.

This sample consisted of a large cylindrical mass of white and solid tallow, very pure and inodorous. There was also a sample of the white kernels from which the tallow is obtained.

Efforts have been made from time to time to introduce this tree into the Punjab; it has succeeded at Kangra, and there are trees at Lahore, Amritsar and Sealkot, and other places. The Financial Commissioner, in his Revenue Report for 1862-63, writes:—

"The China tallow tree, or *Stillingia sebifera*, has seeded this year for the first time both at Amritsar and Lahore. It has been yielding seed at Holta for some years past; but nowhere else in the Punjab. During the last two or three years, the liberal supplies sent to us by DR. JAMESON, have been sown in all parts of the Punjab, so that in a few years more, there is little doubt that the tallow and oil from this tree will be produced in considerable quantities, and become articles of importance." The tree appears to grow with great vigor wherever it has been planted, both here and in China."

1635.—[4213]. Oil of the seeds of the gourd, kadú. Amritsar.

A sample was sent from Lahore also (4243).

1636.—[4245]. Oil of water melon seeds (*Cucurbita citrullus*), kharbúz. Lahore.

1637.— [3244]. Oil of cucumber seed, "tukhm-i-khyár." Lahore.

1638.—[4241]. Oil of lettuce seed, "raughan-i-kahu." Lahore.

1639.—[2927]. Seeds and oil of "rám torái." (*Luffa sp——?*)

1640.—[4251]. Oil of cotton seed, "raughan-i-banaula." Lahore.

1641.—[4335]. Oil of turnip seed.

A sample is sent from Dera Ghází Khán (4403).

1642.—[4239]. Cocoa nut oil. Lahore.

This is made from imported cocoa nuts; it is quite uncommon, and used for medicinal purposes.

1643.—[4239]. The seeds of the *Moringa pterygosperma.* Hushyarpúr.

But there is no sample of the oil. It is this tree which used to yield the Ben oil, prized by clock-makers; the seeds and seed vessels while green, are eaten pickled by the natives.

1644.—[4229]. Purified lamp oil. Prepared at the Sealkot Mission Industrial School.

This is the gingelly or sesamum oil, purified by agitation in sulphuric acid; the acid seizes on, and turns black all vegetable particles in the oil; when the acid is poured off, the oil is repeatedly agitated with water, and then left to settle. The charred vegetable impurities soon subside, and the clear oil is poured off as it floats on the surface of the water.

1645.—[4197]. Deodar oil. *Vern.*—Chilóñ; deár ka tal, from Kúlú. KANGRA LOCAL COMMITTEE.

This is a dark strong smelling oil, of powerful antiseptic properties: it is of the nature of a wood oil, and between an oleo-resin and a true oil.

Oil from the seeds of the deodar cones—with a sample of the seeds.

A very fine sample was sent by DR. JAMESON.

1646.—[ ]. Cedar oil.

This is a thick oily liquid with an empyreumatic odor, which, when allowed to rest, deposits a white flocculent sediment; its specific gravity is 987, when distilled it first gives off water with a little acetic acid, and then a clear yellow oil, specific gravity 965, and leaves in the retort a black resinous mass which solidifies in the cold into a black brittle solid. The yellow oil is a volatile oil with a faint pleasant smell, insoluble in distilled water, but soluble in alcohol or ether. It is turned black by sulphuric acid; with nitric acid in small quantity, it dissolves in water, but if the quantity is increased it is powerfully decomposed, forming a red thick solid. If cooled to the temperature of 10° it does not solidify, but becomes opaque. It burns with a very smoky flame.

The black resin is partly soluble in cold alcohol, partly in boiling alcohol. It is also very soluble in solution of potash; and if hydrochloric acid is added to this, the resin is precipitated in white crystals, which are combustible.

The oil therefore resembles crude turpentine, and the essential oil is somewhat similar to oil of turpentine, but has different odor, it is likely to be useful in those affections, such as rheumatism, hœmorrhage and cholic, in which oil of turpentine is employed.

1647.—[4218]. Pine oil, "raughan-i-chíl." Amritsar.

A sample was sent from Lahore (4242). This was in properties and appearance very like the foregoing.

MEDICINAL OILS.

These consist either of oils, expressed from rare substances, or else are refined sesamum oil medicated with various herbs.

1648.—[4405]. Narúl ka tel. Dera Ghází Khán.

A dark colored and very offensive smelling oil, said to be a medicine for the eyes. The maker will not disclose its contents. It is obviously a compound; the name "narúl" is not to be mistaken for "narel" cocoa-nut.

The following is a list of the rarer oils, and medicated oils used in native medicine. They were prepared by RAM SING of Lahore, under direction of the exhibitor, HURSUKH RAI. A few of them were sent from Amritsar.

The medicated oils expressed from uncommon materials are—

Soap nut—*Sapindus emarginatus*—retá. The black kernels are sent from Lahore (3149); but there is no sample of the oil obtained from them.

Walnut.—*Juglans regia*—akhrot.

Marking nut—*Anacardium semicarpus*—bhiládur (black, acrid and poisonous).

Cashew nut—*A. orientale*—hijli bádám.

Olive—*O. europea*—raughan-i-zait.

——— *Celastrus paniculatus*—mál kangani. Samples also were from Amritsar (4214) and Kangra (4196). A dark red oil, powerfully stimulant.

Large cardamoms—*Amomum cardamomum*—iláchi bari (the essential oil).

Smaller ditto—*Elettaria cardamomum*—iláchi choti.

Cloves—*Eugenia caryophyllata*—laung.

Cinnamon—*Laurus cinamomum*—dar chiní. This is of European manufacture.

Ním seeds.—*Azadirachta indica*—ním. An acrid oil extracted from the pericarp of the seeds; its properties are stimulant and anthelmintic; it is used also in leprosy.

Myrtle berries — *Myrtus communis* — hab-ul-ás.

Said to be very strengthening and promotive of the growth of the hair.

Mace—*Myristica moschata*—jauntari.

Cubebs oil—*Piper cubeba*—Kabáb chíní.

Melon seeds—*Cucurbita pepo*—kharbúza.

Anise seed—*Pimpinella anisum*—anísun.

Fennel seeds—*Nigella sativa*—káli zírí.

Khas khas root—*Andropogon muricatum*—khas.

Pistachio nut—*Pistacia lentiscus (cabulica)*—pistá.

Edible pine seeds—*Pinus Gerardiana*—neoza chilghoza.

Oil of dill seed—*Anethum graveolens*— sonf.

Oil of onion seed—*Allium cepa*—piyáz.

Oil of wild onion—*Scilla sp*——? pyáz jangli.

Beleric myrabolan—*Terminalia bellerica*—halela.

Bakhain berries—*Melia sempervirens*. *Vern.*—Bakhain ; darkona ; hab-ul-ban.

Nutmegs—*Myristica moschatta*—jaiphal.

Spinach seed—*Spinacea oleracea*—bij pálak.

Cabbage seed—*Brassica*—karm.

Seeds of wild rue—*Peganum harmala*—harmal.

Quince seed—*Cydonia vulgaris*—safarjal.

Hemp seed—*Cannabis sativa*—bhang. A sample was also sent from Kangra.

Amaranth—*Amaranthus sp*——?—chulai, &c.

"Raughan-i-jauz" mukaddar (bankor). Given as a medicine for horses.

Cummin seed—*Cuminum cyminum*—zira.

Croton oil—*Croton tiglium*—jamálgota. Samples of the nuts were sent both from Lahore and Amritsar.

Of the medicated oils there is first a series medicated with gum resins and resins.

Raughan-i-balsán.

„ lubán (*Benzoin*).

„ sundras (*Vateria indica*).

„ rál (*Shorea robusta*).

„ baroza (*Pinus longifolia*).

„ gúgal (*Amyris agallocha*).

„ mustagi—mastic.

„ anzarút (*Penœa sarcocolla*).

The medicated herb oils are—

Raughan-i-babuna—camomile.

„ dhatúra—datura.

„ raihán—(*Ocymum pilosum*).

„ sázajin (two kind of "sázaj.")

„ kápúr—camphor.

„ ratanjot—alkanet (*Anchusa tinctoria*).

„ afsantin—wormwood (*Artemisia*).

„ chobchíní (*Smilax china*).

„ banafsha (*Viola serpens*).

„ anjabár (*Poloygonum bistorta*).

„ zambak (*Amaryllis sp*———?)

Useful for earache. The plant is an *Amaryllis*, with thick fleshy stalk, and several flower heads on the crown.

Raughan-i-hana (*Lawsonia alba*).

„ bedmushk (*Salix Ægyptiaca*).

„ kachúr (*Curcuma zerumbet*).

„ sumb-ul-tib (*Nardastachys jatamansi*).

„ aklel-ul-mulk (*Calendula officinalis*).

„ izkhar—flower of (*A. muricatum*).

„ kust—root oil. (Amritsar).

„ sosan.

„ asárán (*Asarabacca*).

„ bach (*Cyperus longus.*)

„ parsiawshán (*Adiantum V. capilli*).

Raughan-i-anjedán.

„ . gauzabán.

, anjirá zard.

„ sir.

„ nirmási.

„ tiri.

„ kaner (*Oleander*).

„ zafrán—saffron.

„ surinján talkh (*Colchicum*).

„ gul-i-lála—tulip flower.

„ shisham (*Dalbergia sissu*).

„ 'ud-us-sálap.

„ filful (*Piper nigrum*).

„ farásiyún.

„ brinj ásaf.

„ vasma (*Indigofera tinctoria*).

„ marzanjosh—marjoram (*Origanum vulgare*).

Raughan-i-farinj mushk (*Ocymum sp.*——?)

„ krishna (*O. sanctum*).

SCENTED OILS AND ATTARS.

The scented oils included 1st, pure tíl or gingelly oils, scented with the flowers of roses, &c.; and, 2nd, attars (*properly 'atr or 'itr.*)

Of the first kind there are—

1649.—[4209]. Raughan-i-gul, rose scented oil. Amritsar.

And (4301) Lahore.

1650. [4215-4216]. Raughan-i-motya and chambelí, jessamine (*J. zambac* and *grandiflora*).

(4300-4303-4305) Lahore.

1651.—[ ]. Raughan-i-rabel, jessamine (*Jasminum sp.*———). Lahore.

1652.—[4217]. Raughan-i-karna, orange flower.

(4268-4299) Lahore.

1653.—[4253]. Raughan-i-majmúa, compound scented oil. Lahore.

The scents from this are "chalchalira," "samb-ul-tib," "kachur," &c., &c., all mixed in a "pot pourri."

1654.—[4232]. "Tel Multání," scented oil. Lahore.

Like "karna," or orange flower oil.

1655.—[ ]. Sandal wood oil. Lahore.

'Atrs are very strong oils, containing the essential oils of the plants and substances used in their preparation; a few drops are sufficient to produce a perfume which is perfectly overpowering, and produces a headache. The natives have the phrase in their language—"dímágh *mu'attar* hona"—to be stupified with fragrance. These attars are principally made in Hindústán, but also at Amritsar and Delhi.

1656.—[ ]. The following is a series from Lahore.

Attar of keora—atr-i-keora—from the flowers of *Pandanus odoratissimus.*

Attar of jessamine—atr-rábel—*Jasminum zambac.*

Attar of double jessamine—atr-chambelí—*J. laurifolium.*

Attar of tuberose—gul-i-shub-bo—from the flowers of *Polyanthes tuberosa.*

Attar of willow flowers—bed-mushk.

Attar of the spring—atr-i-bahár—fancy scent.

Attar of compound essences—'atr-i-majmúa—composed of several kinds of attar.

'Atr pánrí.

'Atr gil (perfume of clay)—this atr-gil is not to be confounded with atr-gil, or otto of roses.

Attar of hena—atr-hanná—flowers of *Lawsonia alba.*

Attar of musk—atr-mushk, scented with musk of the Thibet musk-deer.

Attar of khas, of the khas grass root (*A. muricatum*).

Attar of ambergris—atr-i-'ambar—scented with ambergris.

Attar of jessamine—atr-i-motiya—*Jasminum sp*—.

Attar of roses—'atr-gul—Persian roses.

Atr-i-maulsiri.

A further series from Delhi contained, besides the above:—

'Atr ketgi.

'Atr júi.

'Atr madan mán.

I have no information as to the composition of these latter.

Some of these attars are much adulterated by the admixture of plain oil. Properly speaking they consist of the strong volatile oil from the petals of the highly scented flowers—rose, jessamine, &c.—which yield them. They command a very high price, and many of them, such as "keora," "maulsiri," "panrí," being prepared from flowers which do not grow in the Punjab; are imported from Hindústán. These attars are much used by the wealthier classes of natives to perfume themselves.

As an appendix to this class, it is desirable to reproduce the following "Memo. on the Manufacture of Attar, or Otto of Roses," which appeared in a recent paper of the Proceedings of the Agri-Horticultural Society of the Punjab. The process described is equably applicable to other attars—the proper kind of flower being substituted for the rose leaves.

The following sketch of the method by which the attar of roses is prepared at Lahore was drawn up after an inspection of the apparatus and method of proceeding employed at one of the largest establishments in the city.

1*st.*—*Flowers employed.*—The petals of the ordinary country rose are generally used (*Rosa centifolia*), and occasionally those of the "baramasa," but these are only half the value of the first-mentioned sort, no other kind is found to produce so much, or so good an, essential oil.

Of these kinds of roses, the native druggist believes that about 1,000 maunds of flowers are used annually at Lahore and Amritsar, for the purpose of distilling, the price of each maund being from 2 to 3 rupees, according to the season and quality.

The rose petals are used as fresh as possible, and are first carefully picked to remove any dirt, and also stalks, calyx and stamens.

The Apparatus used.—1st.—A large copper deghí with a wide mouth, and the body sufficiently capacious to hold 4 maunds of water.

2nd.—An earthern flat gamlah employed as a lid; this is perforated with a hole to admit.

3rd.—A bamboo pipe joined to the mouth at right angles, perforated throughout its whole length and secured with a string.

4th.—A long copper vessel, with a narrow neck, into which the bamboo pipe is thrust and plugged with cloth. The vessel is put into a cistern and surrounded with cold water.

5th.—A degchi with a broad mouth.

6th.—A bottle.

7th.—A tin cup.

Quantities used.—Twenty maunds of picked rose leaves, one maund of water, 50 tolahs of *chandan* (oil of sandal wood, *Pterocarpus santalinus*).

Process.—One maund of rose leaves and ½ a maund of water is put into the first degchí, and the cover and tub fixed on with clay, the other end of the bamboo pipe is inserted into the long-necked vessel No. 3, into which 50 tolahs of sandal wood oil is placed, and this vessel is set in the cistern full of cold water. Heat is applied to the bottom of the first degchí until 10 seers of water are distilled over into the sandal wood oil, carrying with them about 3 mashas of genuine attar of rose, which is dissolved by the sandal wood oil.

The apparatus is then taken to pieces, and the rose leaves thrown away. The mixed oil and distilled water are poured into the degchí No. 5, and allowed to stand for some time. The oil rises to the surface of the water, and is separated by a singular but rude process. The operator dips his naked hand flat on the oil which adheres to the skin and prevents the water wetting it, he then raises his hand and scrapes it on the side of a tin vessel into which the oil falls; and is thence poured into a bottle. This process is repeated till all the oil is separated from the water. Then the process is recommenced, the oil is poured into the vessel No. 5, and the water with one maund of fresh rose leaves into the degchí No. 1, and the distillation recommenced and carried on in the same way as before.

This process is repeated for twenty days, and though the druggist considers that 3 mashas of pure attar of rose are distilled every day, yet by the clumsy process of separating the oil and water, so much is lost, that, though 5 tolahs of attar are added to the 50 tolahs of sandal wood oil, yet only 50 tolahs are produced at the end of the process; so that 1 part in 10, is wasted.

The product sells for its weight in silver, each tolah weight selling for one rupee.

SUBSTANCES MANUFACTURED FROM OIL.

SOAPS.

1657.—[1602]. Bars of soap, and cakes of "Windsor" soap. Sealkot. Mr. W. Spence.

4 annas per lb.; cakes, 1 anna each.

1658.—[1604-25]. Family soap and saddle soap, in bars. Sealkot Mission Industrial School. Rev. A. Gordon.

8 annas per bar.

The Superintendent writes as follows:—

"The Industrial School is yet in its infancy. It has been struggling along without capital and without apparatus, except of a very limited character. Its object is to furnish employment to Native Christians and inquirers, and thus eventually to constitute a self-supporting and productive community. Without something of this kind Native Christians of the uneducated classes are but drones on society—not from any fault of their own, but from the nature of the case: cast off as they are from their own communities, and without employment in their new relations.

"Soap is the article on which we have, as yet, spent the most effort. With our present apparatus we can turn out three or four hundred bars a month. The substances used in the manufacture are chiefly fatty matters combined with alkalies. The combining power is heat. After combination it is purified and cast into wells. After hardening it is cut into bars and stamped by machinery, invented and made by ourselves.

"The turpentine exhibited in Sub-class (A.) is distilled by a double refining process, from "gunda-baroza." We can with our present apparatus turn out three or four dozen bottles per month. But there is much difficulty in getting a constant supply of the raw material. It comes from the hills, and very little used by natives except as a medicine, and in one or two trades. There is not a sufficient general demand to ensure a continuous and plentiful supply.

"The lamp-oil is purified by a chemical process, combined with time. The object of the process is to remove all resinous and other foreign matters from the oil, and leave it in its pure state. The extent to which this process is carried on, within certain limits, is regulated by the demand. We are prepared to purify several maunds monthly, provided the market justify us in so doing."

1659.—[.]. Common soap. Lahore.

This is a coarse soap made in moulds consisting of earthen basons. The fatty substance is rape or "sarsoñ" oil, and the alkali "sajjí," which are heated together with lime.

1660.—[2168]. Soap. Gujranwallá. Local Committee.

This is in round convex pieces, of three colors—opaque white, brown and pink—the latter color being produced by the addition of "kusumbha" (*Carthamus tinctorius*).

1661.—[2188]. Soap. Gujrát. Local Committee.

Price 4 seers per rupee.

Made generally from oil extracted from "til" and "sarson" seeds, and sometimes sheep's fat is used. One maund and 20 seers of "sajji" (carbonate of soda) are mixed with about 20 seers of lime, and a small quantity of water is added to the mixture, until it becomes of the consistence of paste or dough. A solution is then made by adding water to the mixture and filtrating several times, and each time pouring the filtrate over the undissolved residue. The solution is then added gradually to 4 maunds of oil and the whole well stirred. After standing for some time the solution is boiled, the superfluous oil rises to the surface and is skimmed off, the soap becomes insoluble; and, when in a half melted state, is drawn off into moulds, and on cooling is ready for use.

Soap was sent also from Jhang Jail (1019-1021); and from Shahpúr (2227); and from Gugaira (2228).

For finer washing and dyeing purposes, the skin or shell surrounding the seeds of the soap-nut tree (*Sapindus emarginatus*) is often used. When mixed up with warm water a fine lather is soon produced, and the most delicate fabric may be washed, and even silks, without destroying the color, which would yield to a coarse alkaline soap. The nuts are produced in parts of the hills, and are called "ritha" or "harita." These nuts contain the principle termed Saponine. Several species have in their bark and roots saponaceous properties. "The exact nature of the principle," says Dr. Royle.* "might be advantageously investigated by chemists favorably situated in the native countries of the plants; and the nature of the changes ascertained which takes place, from the unripe and acrid, to the bland and saponaceous ripe fruit.

S. emarginatus, *acuminatus*, *detergens* and *laurifolius*, all bear saponaceous fruits.

* Illustrations, p. 138.

REPORT ON OILS AND OIL SEEDS.

CLASS IV. SUB-CLASS (B).

THE JURY CONSISTED OF THE FOLLOWING GENTLEMEN :—

MR. R. H. DAVIES,	MR. F. E. GORDON,
MR. R. E. EGERTON,	SIRDAR JASSA SING *of Amritsar.*
MUNSHI HARSUKH RAI,	DR. BROWN (*Chemical Examiner*).

REPORTER—MR. BADEN POWELL.

IT is scarcely necessary to remark on the great importance of this Class, which contains oils and the seeds from which oil can be expressed. There is, perhaps, hardly any product of the vegetable kingdom of such universal utility as oil. 1st, There is the important quality which renders oil a necessity by its combustibility. Next, many kinds of oil are esculent, they are used in cooking, and in cold climates are eaten, with satisfaction, as yielding the large supply of carbon, so necessary for the support of life under excessive cold. As medicines, some of them form valuable aperients, which produce their effect without at the same time injuring the structural tissues of the stomach and intestines; others are valuable as stimulant and vesicating agents; or are powerfully drastic and valuable as a last resort, like the oil of croton; while many other oils form the basis of emulsions and linaments, and are useful for local applications, as for instance, sweet oil in burns. In the arts, besides the immense value of oils as lubricating agents for machinery, they are indispensable to the painter, especially when converted into drying oils; they also form with mastic, copal, &c., valuable varnishes both to the artist, the furniture maker, and the carriage builder.

No wonder then with these and many other uses, oils and oil seeds should be important articles of commerce.

In the Punjab there is a good deal of internal trade in oils, which are carried about in "kuppas," large jars, formed of intestinal tissue, which is boiled into a glutinous mass and then formed over solid clay blocks into the shape desired. When dry, the clay block is crushed and the pieces taken out, leaving a hard hollow vessel. Not a little oil and oil seed, especially "sarsoń" and sesamum, pass on to Bombay by the Indus and other routes. It is to be regretted that there are no exact returns of the exports of oil and oil seeds for the Punjab itself.

To give some idea of the value of the trade in oil seeds, and the great increase observable in it of late years, I extract a passage from the "Edinburgh Review" for January 1864.*

"Within the last 25 years several articles of great commercial value have been added to the exports from India.

* No. 243. p. 102.

"Of these the chief are—oil seeds, jute, wood, coffee and tea. The following statement will show how from a small beginning the trade in these products, has rapidly grown into importance * * * In 1842 the exports of oil seeds from India valued at £2,377; in 1852, it was £501,420; and in 1862, £1,129,469!

"The case of oil seeds is peculiar: up to the time of the Russian war, which shut out England from her accustomed source of supply, the increase of exportation, although large, appeared to have reached its limit, since during the three years ending with 1854, the value of shipments had been stationary; in 1854 it was only £471,797, or somewhat less than in 1852. But the demand resulting from the exclusion of the supply from Russia raised the value in 1855 to £812,799, and in 1856 to £1,273,457, showing how capable India is of responding effectually even to a sudden call, backed by a sufficient price. The value of the exports in 1862 is considerably under the average of the last 7 years, which is £1,480,470."

There is further, with this class of articles no difficulty of cultivation, nor apprehension of extensive failures, as must necessarily be the case with tea, cotton, flax, &c. On looking at the collection of oil seeds, and noting the number of districts producing any one of them, it cannot fail to strike our attention, how little difficulty must attend the cultivation of most of them. Take the common "sarsoñ" for instance—we find this seed grown all over the province, from the inhospitable wilds of the Spiti valley, to the hot plains of Delhi—and and there is scarcely a shade of difference observable between any two samples from any district between these limits that one may choose to examine.

Sesamum, again, is exhibited from the lower hill states of Simla, as well as from Gugaira and from Jhind, and the same with linseed and poppy seed, and one or two others.

It is precisely these common and widely distributed oil seeds that are the most valuable in trade. The oils produced by *Bassia*, *Prinsepia*, *Armeniaca* and *Anacardium*, and some others, are comparatively local—and at present, at all events, unimportant—though in the case of the vegetable tallows of *Bassia* and *Stillingia*, it is impossible to predict what may not be their future commercial importance when the trees producing them shall have become universally cultivated, and the methods of extracting the beautiful white tallow they yield, well known and cheaply practised.

Another point calls also for remark; viz., the great number of plants yielding oil, and the perpetual increase of the number, as year by year, it is observed that plants are added to the lists of oil producers, whose properties of this class were previously unnoticed. All oils may be divided into various classes,—distinguished by certain characteristics, upon which their value in art or medicine depends.

There are the vegetable fixed oils—such as mustard, rape, linseed, &c. Some of these are distinguished by the property of more readily *drying* than others. This gives them great value in the eyes of the painter and of the maker of printing inks. Poppy oil, linseed, and hemp seed oil, have all these properties. They are much increased by boiling the oils, to reduce their bulk to about one half, this is done in preparing printing ink; or the oil is boiled with a due proportion of acetate of lead, and this furnishes an oil highly prized by the artist. The theory of preparing the drying oil is to deprive it of all mucilage which it naturally contains. The basic acetate of lead effects this better than almost anything else, as it combines with the mucilage, which is thrown down as a sediment; the older the oil is, the better for this purpose. Others of these fixed oils possess the property of remarkable limpidity, rendering them valuable as lubricating agents for machinery, &c.

The ben oil, used by watch-makers, is of this nature; as is also the sandal wood oil, and what is called Macassar oil. But all these fixed vegetable oils possess the property of leaving a permanent greasy mark or stain upon paper, which distinguishes them from the *volatile* oils, which do not. Some of these fixed vegetable oils are of great value in

medicine, such as the castor oil, croton oil, marking nut oil ("bhiládar"), &c.; oil of black cummin *(Vernonia anthelmintica)* being either internally purgative and drastic, and externally emollient; or else, as in the case of croton and "bhiládar" oil, vesicating and excitant.

These fixed or fat oils are derived either from vegetable or animal sources, and consist chemically of stearine and elain,* the former being the solid, the latter the liquid, portions; or still further proximately, of stearic acid, margaric acid, oleic acid and glycerine.

It is the first of these, that is the solid element, on which depends the value of an oil or fat for making candles. Margaric acid and the glycerine are of importance in oil for soap-making; and oleic acid in burning oils. The art of separating and obtaining pure and colorless glycerine is almost of recent introduction into Europe, and now pure glycerine is converted into a translucent soap of beautiful appearance, while colorless glycerine is a valuable emollient for application to chapped and rough skin.

The other class of oils are called *volatile* oils. They are generally of a somewhat limpid quality—do not leave a permanent stain as fixed oils do, are generally highly scented, and always strong tasted—they are valued either in perfumery or in medicine, or in both, according to their fragrance. This class includes what are called essential oils. To this class also belong all the attars, which will be noticed presently.

A third class, somewhat poorly represented in the Punjab, includes wood oils, being of the nature of an oil combined with liquid resin and pyroligneous principle, such as the wood varnish of Silhet, and the deodar and "chíl" oils of the Kohistán.

A fourth class includes the petroleum, or earth oil.

From the foregoing considerations, it will be easy to determine not only the class to which an oil belongs, but from a slight chemical examination to surmise the particular value it will have in art, manufacture or medicine.

In the Madras Jury Reports for 1855, there is in the report on oils a portion of a letter from G. F. Wilson, Esq., to Sir W. Hooker, Royal Gardens, Kew, which is valuable, as indicating the method of judging of oils, so as to determine their probable value. As the original report may not be very accessible to my readers, I have extracted at length. The letter runs as follows:—

"Every oil, or grease, whether solid or liquid, if not poisonous or acrid, like croton oil; or viscid and gummy, like castor-oil; or drying, like linseed oil; must be worth in London at least £30 a ton. Among greases solid at above 60° Fahrenheit, the higher the melting point (other things equal), the greater the value: for example, the vegetable tallow of Borneo melting at about 90° Fahrenheit, is worth at least £5 a ton more than the cocoa nut oil of Ceylon, melting at 70°. The effect of the soap duty having been taken off, may probably before long, materially change the relative values of greases; but, at present, liquid oils, like the ground nut (*Arachis hypogea*) are worth more than soft solid oils, like the *Bassia* butter of India, as they require less manufacturing to fit them for use; the liquid oils after a simple treatment in a cheap apparatus, being fit for burning in lamps, while the soft solid oils being neither hard enough for use in candles, or liquid enough for use in lamps, require to go through a press before they are saleable, except for soap-making. Greases may have particular advantages, such as being little acted upon by the air and therefore not easily becoming rancid, but these good qualities can only be ascertained by experiment, which your correspondents had perhaps better leave to us.

"We have been engaged in some experiments upon oils, for use in medicine, in which it seems probable they will take an important place; already one vegetable oil has been found to be almost as efficacious as cod liver oil, with the advantages of being less unpleasant and cheaper. On account of this new use, it might

* *See* BRANDE and URE, *ad loc.*

be well to collect small quantities of oils, even if they did not obey the conditions mentioned above. The value of oil must depend a little (especially when found in out of the way places) upon the way it is held in its matrix; for example, the oil of the 'lumbang' nut (*Aleurites triloba*) can be separated with much less labor and simpler machinery than the cocoa nut oil, which requires very great pressure to extract it from the 'copperah,' or dried cocoa nut kernel.

"Waxes are worth more than greases, on account of their very high melting points; their relative values depend upon color, transparency, and freedom from resinous matter. Resin may be easily detected by lighting a small piece of the wax; the more smoke, the greater proportion of resin, and therefore less value; the paler and more transparent the wax the better. The most valuable tree wax known, is the beautiful insect wax of China.

"A simple way to try an oil nut, is to crush it with a stone, and then squeeze it between your finger and thumb; if it contains any considerable quantity of grease, enough will be pressed out to judge of color, hardness and sweetness; if the nut tastes oily, and yet oil does not come out by this treatment, it is well to dry the kernel before squeezing; and, in the case of nuts containing grease solid at a high temperature like that of the *Myristica sebifera*, it is well also to heat the nut. Where a stearic candle can be got, and is burned down a little, until it has formed a cup, and then blown out, into this a little of the material to be tried may be placed; after a moment's burning, the candle material with which the wick is saturated is burnt out, the new material in the cup, takes its place, and becomes the material supplying the wick until the cup is emptied, and so can be judged of, or a piece of string dipped in the oil or melted grease makes a very tolerable wick; or simpler still, where the nut is very full of oil, if lighted at one end, it will at least show what tendency to smoke there is, and the color of the light.

"Some of the resins ought to come in for candle-making, though I believe that they have never been extensively used, except for the commonest sorts of candles, on account of their giving off so much smoke; but as some descriptions smoke less than others, there is a hope that new ones may be found smoking still less, these would then be very serviceable in candle-making. The points connected with new greases, &c., that we should be most thankful for information upon, are the manner of growth, probable expense of collecting, means of transport, and quantity likely to be obtained, with small specimens of the grease, if manufactured, and of the fruit, with both its husk and hard shell, where these exist."

The collection submitted to the notice of the Jury consisted not only of such oils and tallows of vegetable origin as are contained under Class III., but also for the sake of convenience, those included under the mineral and animal divisions,—classified according to their sources of production, but in themselves too few to demand the attention of a separate Jury. Accordingly the collection included—

1. Vegetable fixed oils.
2. Animal oils and fats.
3. Medicated and scented oils. That is oils having an ordinary gingelly or other oil for a base, but medicated and scented with herbs, roots and flowers, for medicinal or perfumery purposes.
4. Mineral oils.
5. Volatile and essential oils, and attars.
6. Wax and candles.
7. Soaps.

1. *Vegetable fixed oils.*—Consisting of species of "sarsoṅ" oil, "rai" (mustard), linseed, safflower seed, "táráníra," poppy seed, sesamum, and several other individual samples of less common oils.

"Sarhoṅ" oil or "sarsoṅ" oil, one of the most largely produced, is a dark yellow oil, valuable for burning purposes; and if clarified, is a very superior oil. It is, however, apt to become rancid and has an offensive smell. Much of this is due to the very inferior method of preparation commonly followed. As the excellence of an oil depends mainly on its purity, that is, its freedom from mucilaginous matter, sedimentary vegetable particles of the seed and other foreign substances, it follows that any method of manufac-

ture which allows of these impurities in the maximum proportion, must necessarily be eminently defective. The common method of extracting oil is by a rude machine, called a "kohlú;" this is in fact a gigantic wooden pestle and mortar.

A large hollow wooden mortar is fixed into the ground, and a stout wooden pestle is placed into it, leaning against the edge, the force with which it presses is further augmented by a heavy weight. In this position a long pole is attached to the upper part of the pestle, and either oxen are yoked to the pole, or men move it by walking round and round, forcing the pestle with them, its upper end moving round and round against the inner edge of the wooden mortar, and its grinding end working round at the bottom, and crushing the mass of bruised oil seeds placed there. At the bottom of the mortar is a hole leading to a smaller reservoir or chamber cut in the thickness of the wood underneath; into this chamber the oil drops, and is thence drawn off by a pipe which comes out at the bottom of the mortar near the ground, and falls into an earthen ghara or jar placed below the orifice. This is the method adopted in extracting all the common kinds of oil that are made in any quantity; the druggists who extract small quantities of lettuce seed or almond oil, &c., make use of a small screw-press. The bruised seed or nuts being placed in a circular box upon a firm pedestal or foundation, a pressing board sometimes (made of metal if the press is very small, which it usually is) is made exactly to fit into the box containing the seed, and is then pressed down upon the seed by means of a screw worked by a double armed handle, like a clothes press; the oil escapes by little holes in the box into a trough made all round the edges of the box, and the trough is emptied by a pipe or channel into a jar.

A prize was offered for a cheap oil press, but none appeared: it is a great desideratum. The ordinary press in use in Europe is on the principle of first bruising the seeds between iron rollers, and then expressing the oil in a screw press, by steam or hydraulic power. It would not be difficult to contrive an adaptation of the principle within the means of Punjab cultivators. Experiments might be tried, and the example set in jails, where oil extracting is often practised, and deserves to be very much so, as the labor (prisoners being employed) is really hard and distasteful, as the severer forms of prison labor ought to be.*

There was not much difference in the samples of oil exhibited; and all the seeds were precisely alike. Some samples were very thick with impurities. A sample from Hushyarpúr, and one from Gujrát and Shahpúr, were about the best. The oil is much improved by allowing it to stand till the impurities sink, and then decanting off the clear liquid, so that it is possible that some of the cleanest, and especially the small samples, were fallaciously clear and good looking.

Besides the "sarsoṅ" oil, there are several varieties of mustard seeds and crucifers, yielding an oil more or less resembling in color and properties the "sarsoṅ" oil.

The seeds may be enumerated as—"Tarah" or "táráníra," "torya," white "sarsoṅ," black "sarsoṅ," white "rai," black "rai" (mustard) and turnip seed. The white varieties of seed generally impart less coloring matter of the epidermis to the oil, and are somewhat purer and higher priced oils.

* This subject ought to receive the attention of jail officers. Not only is the hard labor extremely useful, since it affords a medium punishment to send a man for so many hours to the oil-mill; but the oil might be made very remunerative on sale, if purified simply by agitating with hot water and salt, and then filtering it first through clean sand and then through charcoal. When once it is known that the jail in a station would supply cleaned lamp oil, there would be a regular demand for it, as cleaned oil is not to be had in the bazar. The Superintendent would buy up a good store of seed when the market was favorable, and thus, with care and management, a good profit be secured with very little outlay.

"Táramíra" is called "assú" in Panjábí, and the inferior kinds of oil yielded by it is called "karwá tel." "Táramíra" oil is esteemed among other uses as a medicine for cattle. It is made in Dera Ghází Khán in large quantities for export to Sindh.

"Torya" is a small seed, and its oil is similar to the others. Turnip seed oil is less common, as is also cress seed (*Lepidium sativum*).

Sesamum oil is prepared just in the same manner, either of washed seed or of unwashed. I have never seen the red-seeded variety of "tíl," spoken of by many authors. There is the common blackish brown variety, which yields the inferior sesamum oil, and if these seeds be first blanched by being boiled slightly in hot water, and then rubbed till the epidermis of the seed comes off, and then the oil be expressed, a much clearer and purer liquid is obtained. The latter process yields about 40 per cent. of a clear pale yellow oil, which is, when fresh, quite pleasant to the taste and inodorous. It is imported into France, where it is used to adulterate olive oil. Its inodorous properties render it valuable to mix with orange flowers, to produce the scented "karna" oil, or with rose or jessamine flowers, to make the Múltání tel, the "raughan-i-guláb," "motya," "rabél," &c. The medicated oils of "lubán" mastic, "asárún," and "ambaltás," &c., &c., are all prepared with white "tíl" oil.

The washed "tíl" oil is that which is usually burnt by Europeans in their lamps. "Sarsoń" oil never answers, both from its impure quality clogging the machinery of a European lamp, and from its bad smell.

Among the sesamum oils is to be noted a very good sample of cleaned lamp oil from the Sealkot Mission Industrial School. This is sesamum or gingelly oil, purified by agitation with sulphuric acid. The acid attracts, decomposes, and turns black the particles of mucilage and vegetable matter. The acid is separated and the oil repeatedly shaken up with water, the foreign matter subsides, and the clean oil is poured off—this is the most effective method. Sometimes oil is agitated with water in a leaden vessel, the lead acting on the mucilage, &c., and causes it to subside, but this is not a very effective plan. Where sulphuric acid is not procurable, washing the oil with salt and scalding water, and then filtering through sand and charcoal, will be found to answer admirably.

The Jury considering also the samples of pure turpentine, and the soap exhibited by the Industrial School, and to be noticed presently, award a Silver Medal and Certificate of Merit for the collection; at the same time commending to public sympathy and support this excellent institution, which aims at finding employment and support for Native Christians, whose change of religion has involved lost of caste and an exclusion from their natural communities, and thus from their ordinary means of livelihood. Such an institute benefits society, not only by converting a helpless population, which would be otherwise dependent, on scant and precarious charities, into a self-reliant and self-supporting community, but illustrates practically to all around, the advantages resulting from improved methods of manufacture of articles hitherto produced only in their rudest and least valuable forms.

Linseed oil.—This is a dark-yellow oil, and is, from the hardness of the seed much freer from mucilage and impurities than the rape seed oils: the native seed, which is smaller and redder in color, is much more productive in oil and much less in fibre than the European seeds. The oil is used to make printing ink, and is a "drying oil," besides being the basis of varnishes for carriages and furniture polish; the Gujrát and Shahpúr samples were very good, as also those from Dera Ghází Khán.

Safflower seed.—This is produced from the white seeds of the *Carthamus tinctorius*. As a dye, the plain districts produce a flower very inferior to the hills, but for oil purposes the locality seems indifferent. There is a wild variety, called "karar," which has a smaller

and mottled gray seed. This oil deserves to be much more extensively produced than it is. It is clear and of a pale golden color; it is esculent; and is said to burn with remarkably little heat: this property would render it invaluable for lamps.

Poppy seed oil.—Is expressed from the black and white poppy seeds; but there is no difference in the oil, which has somewhat a greenish cast; the samples are all good and clear. The seeds are so minute that the amount of impurity and mucilage is very small. The oil is bleached by exposure to the sun. It is invaluable to the painter, and when quite fresh is wholesome enough as an esculent oil.

These are all the oils that are produced in quantity in the Punjab; but the collection contained a large collection of other oils which are used occasionally.

Oils from the seeds of the Gourd tribe —Nearly all the species of gourds and melons, and cucumbers, *L. vulgaris*, *C. pepo*, *C. melo*, *C. utilissimus*, *C. sativus*, *Luffa pentangula*, &c., yield mild clear culinary oils; the skin of the seed is removed, and the inside, under the name of "maghz" khiyar, kadú, &c. &c., sold, and the oil expressed.

Cotton seed yields a pale golden oil, used medicinally.

Lettuce seed gives a clear transparent oil.

Almond oil is expressed by the druggists at the rate of 10 to 13 Rs. a seer (from almonds brought from Persia *viâ* Kabul). A small iron screw press is the implement generally used.

Among the Hill oils, there is a sample sent from Kangra (the only one) of the "bhaikal," or *Prinsepia utilis;* a sample of oil of a clear good appearance from the kernels of the "sári," or *apricot* stones (sent also from Simla). The apricot is cultivated extensively both for fruit and kernel in Kanáwar; and the kernels are sometimes sold in the bazars of the plains, under the name of "badám kuhi." The oil contains a trace of Prussic acid. It is of a deep gold color. The Kangra district sends also a sample of "mahwa" oil (*Bassia latifolia*), accompanied by a box of the glossy brown nuts which yield the oil—the sample is the only one sent.

Walnut oil, is a very valuable oil in hill districts, where the fruit is abundant. It is seldom seen in the plains: the same is true of the oils yielded by the seeds of the edible pine and of pistachio nuts. Among these series were two very fine samples of vegetable tallows—one is from *Stillingia sebifera*, a large cylindrical piece of pure hard white tallow—this comes from Dera Dhún. The *Stillingia* tree is growing in the Punjab, and has seeded, but I have not seen any sample of tallow produced. The other sample is in little snow-white cakes, being the ghí or butter from *Bassia butyracea* of Kamaon; it is esculent, and acts as a pleasant emollient for chapped hands. Both samples are exhibited by Dr. Jameson, and are accompanied by samples of the seeds or nuts of the plants. The Jury are precluded by rule from awarding a prize, as the samples are not the produce of the Punjab; but they desire to mention them with approbation, as most valuable and instructive specimens.

The *animal fat oils* were comparatively few in number, but were nevertheless curious.

A good sample of bear's grease comes from Kangra; as also of leopard's grease. Tiger's grease, prepared as a medicine, was sent by the Gugaira Committee; who also sent very good samples of suet and sheeps' tallow, clarified and prepared for use.

The Dera Ghází Khán collection had two uncommon oils—one prepared by soaking scorpions in common oil, and the other obtained from the fat of the pelican, and called "raughan-i-pín."

The Lahore collection contained an oil extracted from the unctuous bodies of the red velvet insect, "bír búti," used as a vesicating and inflammatory agent; and also an oil called

"raughan baiz-i-murgh," and said to be obtained from hens' eggs, no doubt the egg does contain an oleaginous matter, and egg-shells submitted to dry distillation yield an offensive oil.

It is needless to remark that these peculiar substances are found only in native Materia Medica.

The most interesting, commercially speaking, in this department, were a series of specimens of wax; but they were, without any exception, dirty masses of brownish or dirty-colored wax, which would all need refinement. One beautiful sample of white wax, clarified and melted into a disc shape, was exhibited by Mr. C. A. D. Gordon, the wax being produced in the Gurdaspúr hills. A sample of candles, made from similar wax, was also exhibited by Mr. B. Powell. A very offensive smelling oil is extracted from wax, which, when allowed to evaporate on the finger, leaves a waxy substance in residue. It is used in native medicine under the name of "raughan-i-mom." Samples were sent from Amritsar, from Dera Ghází Khán and from Lahore.

The number of medicated oils was very great; besides a number of rarer substances that yield an oil by expression. There are a large number which consist of a pure sesamum oil, in which is either boiled (as in the case of "mustagi," "lubán," and resinous oils), or else merely steeped, the herb, &c., required. These articles are of no commercial value, and a description of their properties belongs more properly to a consideration of medicines. Among this list there is an oil obtained from the berries of the "bukhain" and "ním," which, is quite uncommon here, but forms an important article of commerce in Southern India, under the name of "*margosa oil.*"

There is one, however, among the medicinal oils that deserves particular mention as being useful for burning, and other purposes also.

This is the "arind-ká-tel," or castor oil, from the fruits of *Ricinus communis*. There are two varieties—one with large seeds. and one with small. A good sample of the former came from Delhi, and of the latter from Kangra. Major Drury says, "that the large seeds yield the burning oil, and the small the purgative oil." The samples of castor oil are very bad. They are quite semi-opaque, and unlike the clear limped sample of cold drawn European castor oil, that was exhibited for comparison. The opacity of the oil is due to the large amount of mucilage and vegetable matter which comes out along with the oil in the very defective mode of extraction employed, which is by the press, and not, I believe, by the "kolú." Castor oil is soluble in spirits, and accordingly a sample of the oil, taken from the Amritsar bottle, was shaken up with rather more than its own bulk of spirits. The oil was taken up and dissolved, but not so the mucilage and impurities. The mixture after being well shaken, was allowed to settle and the spirits to evaporate, the impure parts then separated and coagulated at the surface, as a flocculent whitish mass, leaving clear bright oil of about equal bulk below; hence is demonstrated that the bad quality of the oil is due solely to faulty preparation. It is the custom in some places to roast the seeds first and then bruise them in boiling water, by which means the oil comes to the surface and is skimmed off.

The following improved methods of manufacture are taken from Ainslie and from the "Madras Jury Reports."

"Take five seers of the small castor oil nuts and soak them for one night in cold water; next morning strain the water off and put the nuts into more water and boil them in it for two hours, then strain off. The nuts are then to be dried in the sun for three days, after which to be well bruised in a mortar. Add to the nuts thus bruised 10 measures of water and put on to boil, stirring it all the time until all the oil appears at

the top, then carefully strain off, and being allowed to cool, it will be fit for use. The quantity of nuts mentioned in the above receipe should yield one bottle of oil. If cocoa nut water be used instead of common water, the oil has a paler and finer color."

Another way of preparing the oil is given in the Report of the Juries on the fixed vegetable oils sent to the Madras Exhibition. "The fresh seeds after having been sifted and cleaned from dust, stones, and all extraneous matters are slightly crushed between two rollers, freed by hand from husks and colored grains, and enclosed in clean gunny. They then receive a slight pressure in an oblong mould which gives a uniform shape and density to the packets of seed. The 'bricks,' as they are technically called, are then placed alternately with plates of sheet iron in the ordinary screw or hydraulic press. The oil thus procured is received in clean tin pans, and water in the proportion of a pint to a gallon of oil being added, the whole is boiled until the water has evaporated, the mucilage will be found to have subsided and encrusted at the bottom of the pan, whilst the albumen solidified by the heat, forms a white layer between the oil and the water. Great care must be taken in removing the pan from the fire, the instant the whole of the water has evaporated, which may be known by the bubbles having ceased, for if allowed to remain longer, the oil which has hitherto been of the temperature of boiling water, or 212°, *suddenly* rises to that of oil, or nearly 600°, thereby heightening the color and communicating an empyreumatic taste and odour. The oil is then filtered through blanket, flannel, or American drill, and put into cans for exportation. It is usually of a light straw color, sometimes approaching to a greenish tinge. The cleaned seeds yield from 47 to 50 per cent. of oil, worth in England, from 4*d.* to 6*d.* per lb."

"In France, the fresh seeds are bruised and then put into a cold press. The oil thus expressed is allowed to stand some time to permit the albumen, mucilage, &c., to subside, or it is filtered to separate them more rapidly. The produce is equal to ¼th of the seeds employed, and the oil possesses all its natural qualities. The oils made in France and Italy are much weaker than those procured from tropical countries. Another mode of obtaining the oil is to macerate the bruised seeds in cold alcohol by which 6 oz. of oil are procured from every pound of the seeds. Castor oil is soluble in pure sulphuric ether and alcohol. It also combines easily with alkaline leys, by which is formed a test of its purity. It is one of the best ways of overcoming the repulsive taste by mixing the oil with an alkaline ley, which alters the appearance of the oil, but does not destroy its purgative powers. Other ways of rendering the oil less unpleasant are by using lime juice, orange peel, coffee, gin, or an emulsion of the yolk of egg. Castor oil is a mild laxative medicine, and among the Hindús is used as a remedy in cutaneous affections externally applied. It is particularly recommended in rheumatism, lumbago, and habitual constipation, piles, and other diseases of the rectum. Alone or mixed with turpentine it is efficacious in expelling worms. Air should always be excluded to prevent rancidity. although when rancid, it may be purified by calcined magnesia."

The plant is very easy to cultivate, if sown in a moderately moist place, after the rains. It would form a valuable plant as a hedge to jail gardens, &c. The leaves are food for silk-worms.

The *scented oils* have been before alluded to. The principal kinds are "karná tel," "raughan-i-guláb," "motya" "rabel," &c. They are prepared by taking pure white "til" oil (gingelly), and soaking in it rose petals, or jessamine, or orange flowers, &c., as the case may be. They are pleasant and not too powerful; but the perfume soon goes off. They would make very good hair oils.

The *attars and essential oils* are very well represented.

Attars are mostly the volatile oil of flowers. The petals are placed in a still with a little water, and the liquid gently and carefully distilled over: on the surface of the liquid which passes over is found floating in small quantities the essential fragrant oil which is carefully skimmed off and preserved. The essential oil distilled from cloves, &c., is heavier than water and sinks instead of floating, There are one or two other attars prepared from musk, ambergris, &c.; and one of these, (the composition is not known,) is distilled, or said to be so, from earth or clay: this is the "atr *gil*," not to be confused with (atr *gul*): it has a peculiar and pleasant smell, less powerful than most of the others.

The attars are some of them prepared at Amritsar; but some, such as the attar of the

flowers of the *Pandanus odoratissimus*, are brought from Hindústán *viâ* Delhi, and from Benares.

These perfumes are so powerful, that the smallest drop is almost over-powering, and produces a sensation of nausea with eventual headache.

The lemon grass oil is perhaps one of the most pleasing of this nature, and is extensively prepared in Ceylon. One or two samples of lemon grass were sent to the Exhibition, but no oil. The grass is very common in parts of Bengal.

A fragrant attar is however obtained from the "khas" (*Andropogon muricatum*), a cogener.

There were several seeds exhibited, but no oil with them. The seeds of *Moringa pterygospermum*, were thus sent from Hushyarpúr, and the black kernel of the "haríta," or soap nut, from Lahore; as also a seed or brown nut, called "namúlí."

Wood oils, as before observed, are only represented by a dark-colored empyreumatic oil from the *Pinus longifolia;* and another from the *Cedrus deodara*, which is sent both from Kangra and Simla; and a fine sample of oil from the *seeds* of the deodar (not the wood) is exhibited by Dr. Jameson.

This concludes the oil series.

The Jury award as follows:—

The Special Prize of Rs. 25, offered by the Punjab Railway, for the best collection of native oils, is awarded to Ram Singh of Lahore, who exhibited a complete series of nearly 150 samples, embracing all the fixed vegetable oils, medicinal oils, scented oils and attars, and animal oils, in one. The Jury have augmented the Prize by Rs. 10, making a total of Rs. 35.

The Second Prize of Rs. 25, is awarded to the Local Committee of Kangra, for the excellence of the oils, and the interest attaching to individual samples, such as *Prinsepia* oil, "mohwa" oil, and bears' grease.

To the Local Committee of Shahpur, a Prize of Rs. 15, for general excellence of the oils.

A Certificate of Merit is given to the Gujrat collection, for pure and good oils.

The Jury make Honorable Mention of the collection from Dera Ghazi Khan.

To Mr. C. A. D. Gordon, a Certificate and Prize of Rs. 10 is awarded, for white wax, produced in the Gurdaspúr Hills.

Soaps.—The collection includes several samples of native soap, all made on the same principle, with oil, "sajji" and lime; the best of them is a sample from Gujranwalla, got up with some care, and some of the cakes colored pink with "kussumbha." This soap is a harsh material, useful enough for scrubbing and cleansing purposes, but not pleasant to wash with, and its smell is somewhat unpleasant.

But the most excellent sample of soap, quite surpassing any other, is that produced under the name of "saddle soap" and "family soap," by the Sealkot Industrial School, before alluded to. The soap is of the nature of a yellow soap, and semi-transparent wax-like, yields easily to water, and lathers well. In addition to a Medal and Certificate awarded to this school, the Jury awarded a Prize of Rs. 30 for soap: this sample only shows how all the materials are at hand for producing a first-rate article of such wide and necessary consumption.

Second only to this sample, is the soap made and exhibited by Mr. W. Spence, of Sealkot, and who is believed to have been the first to start the improved process at Sealkot. He has a useful scrubbing soap in bars, and some neatly stamped round cakes of a scented brown soap.

To this sample the Jury awarded a Certificate of Merit.

On reviewing briefly the whole collection, there can be no doubt that the materials for first-rate oil production are at hand, but some improved method of extracting the oil must be found and adopted before any permanent improvement can take place. The Jury commend this subject to the notice of officers in charge of jails.

The subject of cleaning oils, too, is an important one, and deserves attention.

The production of wax is another very important subject. If pains were only taken it might be produced in great quantity, and as the bleaching requires little else than light and air, no difficulty need be experienced. The whole process of purifying wax in Europe consists in forming the wax into thin ribbands or shreds, so as to expose it on trays to light, dew, and air, &c., for some time. There is no reason why this province, with wax like the sample shown by Mr. Gordon, should not be quite independent of Europe for candles.

As to animal fats, there seems to be no lack of supply, but some classes of natives have caste prejudices against this manufacture—though fats appear to yield better soap than the mustard oils commonly used. In Europe, bones are boiled down to yield fat, which they do in large quantities; the waste of animal matters which is perpetrated in India must be enormous—the subject is worth attention. In Paris, the very dead dogs from the Seine are boiled down for tallow; and the skins of the rats in the sewers, are converted into kid gloves!

These are perhaps extreme instances, but the maxim—waste not, want not—is as true in India as in Europe, and as the tendency of trade extension and civilization is to utilize everything, from the most beautiful products of nature down to the vilest refuse.

B. POWELL,

Reporter to the Jury.

CLASS IV. SUB-CLASS (C). SUBSTANCES USED FOR DYEING, INCLUDING CLOTHS DYED TO ILLUSTRATE THE PROCESS; PRINTED OR STAMPED FABRICS, AND BLOCKS USED IN MAKING THEM; INCLUDING ALSO, ARTISTS' AND OTHER TRADES' COLORS.

In order to see the whole of the substances made subservient in this Province to the art of coloring, whether of dyeing or printing cloths, or painting, or enamelling, the reader should look back to the pages under Class I., already devoted to a consideration of such of these substances as are yielded by the Mineral Kingdom.

The present Sub-class, however, includes the majority of these substances which are products of the Vegetable Kingdom. . In presenting to the reader a brief account of the principle colors which the dyer is capable of imparting, I shall notice all dyeing materials used, without reference to their origin.

The apparatus of a native dyer is very limited and inexpensive. His fire and pans, wherein he can boil such articles as require it, earthen "nánds"* and jars of various sizes, and cloth for filtering, constitute almost his only requisites. The workshops of native dyers are generally dirty in the extreme—notwithstanding this, colors of surprising beauty are often produced.

Some of these colors are very permanent; but others, perhaps the majority, are not so; and the art of brightening and fixing by mordants is very imperfectly practised. The principal varieties of fabrics submitted to dyeing are—*silk*, *cotton* and *wool*—and the processes as well as the materials, differ somewhat in each.

The following is a list of colors which can be produced, both simple and compound; and of the substances used in the production of each.

* Called in Punjábi "matt."

Red, with yellow spots, &c.—Dyed first yellow, then wherever the spots are, the cloth is gathered up into a little bunch and tied tight all round with thread. In this state the cloth is dipped in kussumba, and when it comes out the whole cloth is red, except where the little knots were formed, which, when the cloth dries, the knots are opened out, and there are little yellow spots in the place of each.

Red, with white spots.—Prepared on the same principle, only the white cloth is first tied up and then red dye applied. It is not necessary to enumerate all the varieties of colors that are prepared in this way, as the principle is the same in all cases.

Surkh—crimson.—Kussumba, brightened with kishta.

Gulanár—scarlet—Kussumba and turmeric (haldi).

Kirmzí—crimson.—Kussumba; and then with a very faint shade of indigo, dissolved as for indigo dyeing.

Nátarmáuí—lilac—mauve.—Kussumba, and then "nil kachá," the common indigo merely pounded up fine in water, not dissolved regularly as for indigo dyeing.

Sosni—lilac.—Kussumba and "nil pukhta," or dissolved indigo.

Nárangi—orange color—Tún flowers and kussumba.

Kesari—sort of saffron color.—Ditto, in fixed proportions.

Sunehri—gold tint.—Ditto.

Kásni—very pale lilac.—Kussumbá and "kachá níl" (indigo).

Gul ámbarí—A sort of bright lilac, in which the crimson and the blue are not thoroughly combined, so that there is the effect of a "shot."—Kussumba and Prussian blue (Wilayití níl).

Piyázi—very pale pink or flesh colored.—Kussumba and khataí (lime juice).

Gulábí—pink—Ditto.

Sandal-i-surkh—reddish brown.—Kath gulábi (catechu) and kalai (whiteing).

Sandal-i-safed—drab yellowish cast.—Kath (catechu only).

Shutri—camel color.—Catechu in proper proportion.

Halwai—color of sweatmeat—pale drab.—First with naspál, pomegranate rind, then with catechu.

Agrai—drab.—In the same way, with different proportions.

Túshi—dark brown gray.—Naspál and catechu.

Múshi—rat color.—The same in proper proportions.

Lajwardi—ultramarine.—Lajward—artificial lapis lazuli.

Shingarfí—Cinnabar—Cinnabar ground fine (not permanent).

Mallageri—shade of brown.—Catechu only.

Sardai—color of ripe melons.—Tún flowers (yellow), and a faint shade of kussumba.

Angúri—pale green (grape color).—Asbarg, turmeric and "nil kachá."

Sabz.—green—Naspál, turmeric and indigo dissolved.

Zamrúdi—deep green.—Naspal, indigo, turmeric and alum.

Zamrúdí mail siyaí—very deep green—"invisible green."—The same, with more indigo.

Siyah bhor—the color of the black bumble bee (bhor).—Dissolved indigo, naspál, turmeric and alum.

Naswári—snuff color.—Catechu only.

Fakhtai—gray—Kikar pods and catechu.

Champa-i-zard—(champa flower color).—Tún, and a little kussumba afterwards.

Káfúri seotí—yellow pale.—Tún flowers.

Kapásí—color of flowers of cotton plants.—Turmeric, then asbarg and alum.

'Atishi gulábi—bright rose color.—Kussumba and khatai.

Basanti—yellow bright pale lemon.—First turmeric, of the sort called agrai, the best, which easily breaks* up, and asbarg and alum.

Basant-i-mail surkhi—yellow with crimson tint.—Turmeric, and then a little kussumba, and then a solution of alum.

Firozí—Turkis blue.—English sulphate of copper and whiteing (not fast).

Shákh chinárí—(lit., plane tree branch)—it is yellow with a suspicion of black or blue.—Asbarg, and then indigo kachá.

Tabáshírí—pale yellow with tone of blue.—Asbarg, and a little indigo kachá.

Kulfi—deep lilac, blue prevailing.—Kussumba and dissolved indigo.

Dárchíni—cinnamon colored.—Catechu.

* *See* "turmeric" in the sequel.

Zirai—shade of brown drab (color of zira or cummin seed).—Naspál and catechu.

Khákhi dúdhyá—gray.—Kikar pods and catechu.

Yashmi—color of jade stone.—A little turmeric first, then asbarg and alum.

Khákhi mail siyahi—darker gray.—Catechu and kíkár pods.

Gerái—dark red.—Geri—earth.

Surmái—deep blue-black.—Indigo.

'Abi—pale blue.—Indigo.

'Abi nukrai—silver gray.—Pale indigo.

'Asmáni—sky colored.—Indigo.

Kakrezi—liver colored.—Bakm (sappan) and catechu, and naspál.

'Unábi—(color of bér fruit—reddish).—Bakm and naspál.

Nabátí—pale brown like sugar.—A little kussumba and then tún.

Gul-gaz—crimson brown, maroon.—Kussumba and a little catechu.

Gul-abbási—color of Marvel of Peru—magenta.—Kussumba and a shade of blue.

Zangári-pukhta—verditer, permanent blue.—Copper filings in solution of sal-ammonic and borax.

The process is peculiar, the cloth is first carefully steeped in the white of eggs beaten up into a froth. When this has been thoroughly accomplished, the cloth is spread out, and very fine copper filings are sprinkled all over it, and the cloth is then tightly rolled up enclosing the filings: the roll is next moistened with a solution of borax and salammoniac, and is kept kneeded and rolled about for some time, while the operator constantly sprinkles it with the solution: the color produced is permanent.

Zangár kachá—verditer (not permanent).—Is made by dipping cloth into a solution of zangár, the subacetate of copper.

Vakmí—lilac pink.—Vakm, naspál and alum.

Vakmi kulfi—purple.—First with indigo, with alum solution; and lastly, vakm.

Pisia—green (pistachio).—Naspál, turmeric, raw indigo, and alum.

Majit—madder red.—The cloth is first steeped in galls of tamarisk (máin), and then washed in oil, and then rinsed, after which it is dried, and then dipped in a madder vat.

1662.—[ ]. Indigo, níl (*Indigofera tinctoria*).

The native term "nil" is generally written with the term "kabúda" added to it, so as to prevent any one mistaking the word for "tel," oil, which is the same form in the Persian character, with a difference only of the dracritical points.

The various sources of indigo are fully discussed

in the Jury Report; here it may suffice to observe that the indigos exhibited are all from the same botanical source, and are all that kind of indigo, which is called "gaud," that is merely in sun-dried pieces, without boiling or preparing in cakes.

The indigo from Múltán, and from the factory of MESSRS. SKINNER AND JARDINE at Hansi, and an imported specimen from Khúrjá, are the only exceptions; these are prepared in square cakes, previously purified by boiling the fecula. Indigo is by no means generally cultivated, although many districts appear to produce small quantities for their own consumption.

Dera Gházi Khán and Múltán are the great places for manufacture. In the former the trade has fallen off, on account, it is said, of adulteration practised on the goods; but formerly very large quantities were made and exported into Kábul and Khurásán, &c., by the Loháni Afgháns. As it is, about 2,000 maunds are yearly made in the district, at prices varying from Rs. 25 to 60 per maund.*

The prospects of indigo in the Punjab are thus alluded to in the Revenue Report for 1861:—

"As regards indigo, likewise, which ought to be one of the staple products of the Punjab, there is no improved progress to be noted this year, 1861-62. But as I was under the belief, as stated in my report, that owing to its defective manufacture, the article as here produced is not fitted for the Europe markets; I have read with satisfaction the subjoined extract† from a newspaper published in Kúráchi, under the designation of 'Our Paper,' which affords a hope that it may yet be turned to account."

Attempts have been made to revive the manufacture at Sealkot, and though the produce is "gaud" indigo, it is very superior to what is produced in many districts.

MR. MACNABB, Deputy Commissioner of Sealkot, in 1862, wrote: "Last spring I got up one maund of seed from Allygurh, and made it over to HAKIM SING of Daska, and to a chaudri at Zaffrwál. The fourth of the cultivation of the former, and a good deal of the latter, were destroyed by floods, but we have 10 maunds of seed, which is enough for half the district.

"The specimens were good in color, but dirty and badly made, as was to be expected, as they were prepared in rough mud vats by unskilled men. All that is now wanted is to build pattern vats, and get up a well qualified man for a year from Allygurh to give instruction in the process."

The dyers acknowledge four kinds of indigo—1st, the best and dearest, "Wilayití nil," or indigo prepared in Bengal or the N. W. Provinces after the improved European fashion; 2nd, "Khúrjá nil," is indigo brought from Khúrjá, a town situate between Allygurh and Delhi; the 3rd, is "Multáni nil," from district of Múltán, to be described presently; and the the 4th, the most inferior, is the "desi," or common provincial made indigo, either from this district itself, or brought thither from some other district of the Punjab.

The first two kinds need no remark, as they are imported, and the methods of growth and manufacture followed in the regular indigo districts cannot here be discussed; some notice of the subject, however, offering suggestions for the improvement of the local manufacture, will be found in the Report of the Jury annexed to this class.

The principal and most hopeful source of indigo is at present the Múltán district. "The Punjab Indigo Company" have recently established themselves there, and with every promise of success. For the growth of indigo in Múltán, a light rich soil is preferred, which has neither too much sand nor too much clay; the presence of "kalr" is fatal to the indigo crop. The high lands, called *ootar* or *ráucá*, are the best suited; constant irrigation is required, and that from canals, called *phuggoo*, is preferred; not much indigo is produced in lands watered by wells, because the irrigation is not sufficiently constant; for a similar reason indigo does not grow in "sailába lands" (irrigated only by temporary or periodical floodings). The sowing time is in the months of Baisakh and Jeth: the field is first ploughed four or five times, and then flooded with water; after which the seed is sown broadcast; the land is prepared for sowing during the cold weather after the winter rains. If sown in Baisakh or Jeth, 6 seers of seed suffice to sow one begah; but if later, 8 seers are required: but this one sowing lasts for 2 years—for the first year's crop being cut the plant grows up again—the second year's growth is called *moandean*. The best lands

* Punjab Selected Correspondence, Vol. IV, Part 4, p. 63.

† Extract from "Our Paper," of 20th June, 1862.

"Indigo, which from the crude manner of its preparation in Sindh has been hitherto unfit for the English market, has, in the past year advanced from rupees 3,60,859 in 1860-61, to rupees 11,03,544 in 1861-62. It appears to have been but lately discovered in England that Múltán indigo, notwithstanding its impurities, is of good color, and therefore possesses the quality which constitutes the chief value of this article. Some has been imported from Khyrpoor this year, which is superior to that of Múltán; and is consequently valued at rupees 10 a maund more. As the plant is indigenous both in Sindh and the Punjab, its produce might be exported to an indefinite extent. Heretofore it was exported only to the Persian Gulf, Afghánistán and Bombay; but in the past year, for the first time since 1847, several cwt. have been exported direct to England; and much of that forwarded to Bombay is also, it is believed, destined for that market."

will even produce a third year. If sown in Baisakh one beegah of land yields 10 seers of indigo the first year, and 8 seers the second; the expenditure of the cultivation for the first year is about Rs. 6-2-0 per beegah. The land is irrigated twice before sowing, and after that every third day for a month, at which time the plants are a foot high. After this, irrigation on the eighth or tenth day suffices, but a nice discrimination is requisite as to the quantity of water, too much being almost as bad as too little, causing the leaves to turn yellow and deteriorate.

Manure is not usually given, but weeding is carefully practised.

The production of indigo in Múltán began with the construction of irrigation canals, which were zealously promoted both by the Pathan rulers, and subsequently by the celebrated DIWAN SAWAN MAL. In those days the Government took no money assessment on indigo lands, but the zemindars paid "bhaoli" rates, or proportions of the gross produce, varying according as Government or the zemindars had constructed the canal inundating the land. If the Government had borne the expense, the rate was from ¼th to ⅓rd; if the zemindars, then the proportion assessed was from ⅕th to ⅙th. SAWAN MAL was a great promoter of these canals,* to such an extent that he realized from the Sirdanah of the Ladrán tehsil, 900 to 1000 maunds of indigo, where the Pathans only got 200.

Indigo grows to a height of 4 to 5½ feet. It is ripe and ready for the sickle when it begins to blossom. It is always cut before the seed-pods begin to form, and is cut about 6 inches or a foot from the ground. "Another test of preparedness," says MR. MORRIS, "is to take a leaf in the hand and rub it, if it leaves a black stain it is ready, not otherwise."

The vats, called "hauüs," used for the manufacture, are built in sets of three—a large one on each side and a small one in the middle—the large ones are about 4½ feet in diameter, and 3½ feet deep, the small ones, half that size. It costs about Rs. 30 to build a set. When the plant is ready for cutting two men are required on 5 Rs. a month each, one to cut, and the other to tend the vats. The indigo being cut, is tied up in bundles. Eight or ten of these are placed upright, with the stalks downwards in the larger vats. At evening water is let on to cover the whole, but the bundles must not be left too long without water, otherwise the plant dries and is spoilt. The soaking continues for 24 to 36 hours, after which the bundles are removed from the vats, and the liquid is churned or agitated for some time by men with long paddles. The exact duration of this process, which is called "balowa," is a matter of great nicety, learnt only by experience. When this is done, the indigo sediment subsides, and the water above is drawn off; the sediment or fecula is then collected in the smaller vat, is strained through cloths, and dried in the sun, in little balls or cakes.

It appears that indigo cultivation fell off somewhat at the commencement of British rule, consequent on the Government having no motive for promoting any one particular crop, and partly because the canals were not so much attended to. But now that the company is at work, irrigation becomes a subject of great importance, and it is suggested that many of the simple Chinese expedients would be invaluable, especially for those estates which lie above the level of the inundation canals, and require to be watered by "jhalárs," Persian wheels erected over the edge.

There are three kinds of indigo produced—the first, and best, is distinguished by having a reddish lustre when polished with the nail—this is called *pammuáh*, and sells for Rs. 50 to 80 per maund. It is produced chiefly in tehsils Shujabad, Ladrán and Múltán.

The second is called "pakka sáwah," and values for Rs. 40 to 60 per maund.

The third is called "kacha sáwah," and sells at Rs. 25 to 40 per maund.

MR. MORRIS writes:—"From the above description of the manufacture it will be seen how rude the mode is, and how ill-calculated for the production of so rich and valuable a dye; still, notwithstanding this, it is greatly sought after by foreign merchants, and large quantities is exported to Bombay, Kábul, and other places. I have heard that notwithstanding the rudeness of the manufacture, the actual color is so good as to astonish the Bengal planters who have seen it."

MR. MACIVOR in 1855, wrote: "That he had tried experiments, and had made a sample of this indigo. He sent his sample, with some of the ordinary native production, to Bengal. His sample was valued at Rs. 140 per maund, while the other was pronounced not worth the cost of transport!"

Such a result should be highly encouraging to the indigo company, since it conclusively shows how intrinsically excellent the dye is, while at the same time, how enormously its success in the market is dependent on the "get up" and manufacture, which are just the points that the company will have widest scope for improving.

To show what other districts do in the way of cultivating indigo, the following particulars were communicated to the Punjab A. H. Society.

* *See* Chapter on Agriculture; also MR. MORRIS' account, "Calcutta Gazette," Dec. 19th, 1860.

From the Deputy Commissioner, Dera Ismail Khán, dated 10th February, 1863, stating, "that the indigo cultivation of the district did not exceed 50 acres; the price averaging about Rs. 70 per maund."

From the Deputy Commissioner, Ludhiana, dated 11th February, 1863, stating, "that there are probably not more than 1,000 acres of land under indigo cultivation in the district, the average yield of dye being about 17 seers per acre, and the selling price ranging from Rs. 30 to 45 per maund."

From the Deputy Commissioner, Jálandhar, dated 9th February, stating, "that the whole area under indigo cultivation amounts only to 495 acres, the average produce of the dye being 16 seers per acre, and selling price from Rs. 25 to 40 per maund."

From the Deputy Commissioner, Shahpúr, dated ———, stating, "that the cultivation of indigo is limited to a merla or so, here and there, grown for private consumption as a hair dye."

From the Deputy Commissioner of Ambálah, dated 23rd February, stating, "that 428 acres are under indigo cultivation in the district, that the average yield per acre is 16 seers, and that the price is Rs. 60 per maund."

From the Deputy Commissioner, Dera Ghází Khán, dated 13th February, 1863:—

"In this district, at a rough calculation, about 15,000 acres are cultivated with indigo, the average out-turn gives about 12 seers of manufactured indigo to the acre, so that about 4,500 maunds are manufactured yearly in the district; the average price is 40 Rs. a maund, giving Rs. 1,80,000 as the value of the indigo grown and manufactured in this district. About three years ago there was a great demand for indigo, and the cultivation of this plant was largely increased; since then the demand has lessened and the cultivation of the plants proportionately decreased. The plants of the first season are called 'rop,' and are the best; the second year, it is called 'moonds,' and is not so good; and the third year 'jis moonds.' It is kept only for seed. I will send two specimens of the manufactured indigo, the best kind and the average kind, with present value, in the course of the next few days. Any further information you may require shall be happy to supply."

There were 14 samples of indigo, in the Exhibition of 1864.

1663.—[4558]. Sample of indigo from MESSRS. SKINNER'S factory, by the Lahore Museum.

1664.—[ ]. Indigo. PUNJAB INDIGO COMPANY, Múltán.

1665.—[ ]. Gaud indigo, from Múltán.

Samples were exhibited from—
(4546-47) Sealkot.
(4438) Delhi.
(4446) Gurgaon.
(4452) Hissar.
(4464) Ambálah.
(4467) Ludhiana.
(4477) Jálandhar.
(4532) Amritsar (Multání nil).
(4636) Muzaffargarh.
(4643) Dera Ismaíl Khán.
(4645-66) Dera Ghází Khán.
(4663) Kapúrthalla.
(4680) Jhind.
(4683) Pattiala.

1666.—[ ]. "Vasma," or "kalf." Powdered indigo leaves.

The dried and powdered leaves of indigo plant are used especially in hair dyeing. This operation is prepared by first dying the hair red with "mendi" (*Lawsonia*) leaves, and then indigo powder is applied which makes it black; I believe also the curds of milk are employed in the process.

Samples of "vasma" were sent from—
(4592) Gujrát.
(4621) Gugaira.
(4647) Dera Ghází Khán.

1667.—[ ]. Madder. *Vern.*—Manjít, majíth, rodang (*Rubia munjista* or *R. cordifolia*). Called in Thibetan, "bTsod," and in Bunan dialect, "runa."

Madder is one of the most remarkable dyes, not only on account of its having like indigo no affinity for any mordant; but also from the peculiar chemical principles it exhibits on analysis.

The madder used by the dyers in the Punjab is principally that which is imported by the Lohání Afghans, from the hills of Northern Bilúchistán, Kábul and Khurásán, and brought in large quantities to Múltán by the Shikárpúr and South Afghan Povindahs, and through the Khaibar and northern passes by the Peshawar Kábul merchants. But madder abounds in the hills of the Himálaya, and in Naipál, while it grows also in the Nilgiri hills of Southern India. DR. CLEGHORN, speaks of it as growing in profusion in the valley of the Chandrabhága (Chenáb), and says that it is indigenous to the vallies of the Himálaya. A sample of madder is among the collection from Lahaul. Some French seed has been planted in the Punjab plains, and is growing now at Amritsar; but

as the plant takes three years to come to maturity, the root has not yet been tested.

Madder is chemically speaking one of the most remarkable of dyeing substances, and the comprehension of its constituents will do not a little towards suggesting improvements in, and extension of, the series of tints capable of being produced by the root.

The European madder is *Rubia tinctorum*, but another species, *R. peregrini*, is brought under the name of "Turkey roots" from the Levant, and much used in the process of dyeing Turkey red.

It is quite recently that a difference has been discovered between European madder and "manjit." The latter being found to contain a curious principle, termed munjestine. A brief account of the constituents of madder is here added, partly on account of the value to the dyer, attaching to a knowledge of the properties of madder, and partly to illustrate the difference of the madders of Europe and India.

When madder is extracted with boiling water, a dark brown muddy liquid, having a taste between bitter and sweet, is obtained. On adding a small quantity of an acid to this liquid, a dark brown precipitate is produced, while the supernatant liquid becomes clear and now appears of a bright yellow color. The precipitate consists of alizarine, purpurine, rubiacine, the two resinous coloring matters, pectic acid, oxidised extractive matter, and a peculiar nitrogenous substance. The liquid filtered from this precipitate contains the bitter principle and the extractive matter of madder, as well as sugar and salts of potash, lime and magnesia. No starch, gum or tannin can be detected in the watery extract. After the madder has been completely exhausted with boiling water, it appears of a dull red color. It still contains a quantity of coloring matter, which cannot, however, be extracted with hot water, or even alkalies, since it exists in a state of combination with lime and other bases, forming compounds which are insoluble in those menstrua. If, however, the residue be treated with boiling dilute muriatic acid, the latter dissolves a quantity of lime, magnesia, alumina, and peroxide of iron, as well as some phosphate and oxalate of lime, which may be discovered in the filtered liquid; and if the remainder, after being well washed, be treated with caustic alkali, a dark red liquid is obtained, which gives with acids a dark reddish-brown precipitate, consisting of alizarine, purpurine, rubiacine, resin, and pectic acid. That portion of the madder left after treatment with hot water, acids, and alkalies, consists almost entirely of woody fibre.

The most important principles in madder (excluding pectin, nitrogenous matter, resinous coloring matter), are alizarine, purpurine, and rubiacine.

Alizarine ($C_{14}\ H_5\ O_4$) is a principle obtained* in yellowish red, lustrous acicular crystals.

At about 42° Fahr. these crystals sublime on hot charcoal, and when the sublimate is collected, the residue is pure anhydrous alizarine. Alizarine is insoluble in cold water, sparingly so in hot, quite so in alcohol, yielding a deep yellow solution. It is destroyed and made colorless by chlorine; and by nitric acid is converted into a colorless crystallized acid, called *phthalic acid.*

In caustic alkalies, alizarine forms a solution of a firm purple or violet color—if ammonia be the alkali employed, it will evaporate and deposit the alizarine as crystals. These alkaline solutions yield with lime and the salts of baryta, beautiful purple precipitates, varying from purple to black; as also with iron salts. Indeed, most of the salts of metallic oxides yield various shades of purple precipitates. The salts of alumina gave a red precipitate. Hence cloths prepared with solutions of mordants of the salts just named, can be dyed with pure alizarine, and the depths of the tones produced may vary from pink and lilac to red and black, according to the strength of the mordant used: nevertheless, it is found that the other constituents of madder aid in forming the purples and red, and that (these) colors when produced with madder, and not merely with the extracted alizarine by itself, are more powerful than when dyed with alizarine extract alone; while the delicate shades of pink and lilac was found to be almost wholly dependent on the alizarine alone. This fact is very important to the dyer.

Purpurine, the second mentioned constituent of madder, is very similar in appearance to alizarine. It crystallizes in small orange-colored or red needles. It can be sublimed, is sparingly soluble in boiling water, giving a pink solution, and in alcohol with a deep yellow. It yields, like alizarine, ***phthalic acid*** on treatment with nitric acid, but ***unlike alizarine, it is soluble in alum liquor.***

"When treated with a boiling solution of alum in water it dissolves entirely, yielding a peculiar opalescent solution, which appears bright pink, being transmitted and yellowish by reflected light."—(Ure).

When the alum solution is cold, if sulphuric or hydrochloric acid be added in excess, a precipitate of yellow flakes of purpurine falls. ***On this property depends the method of separating it from alizarine.***

The compounds of purpurine with bases are purple.

* Alizarine was obtained by Robiquet by making a cold solution of madder, which he allowed to gelatinize, treated the jelly with alcohol, evaporated the alcoholic liquid to dryness, heated the dry residue and the alizarine sublimed, and was collected as a dry crystalline sublimate.—(Ure).

It dissolves with caustic alkalies, with a bright purplish red color, the solutions *unlike alizarine*, lose color and change by exposure to air. The *reds* and *blacks* yielded by purpurine are superior to those yielded by alizarine, being more intense. This explains the statement above, that the reds and blacks dyed by madder (containing both, is alizarine and also purpurine) were better than those dyed only by alizarine; but on the other hand, the purples and violets of alizarine are better than those of purpurine, which also explains what was said before.

Purpurine colors are, however, less fast than alizarine, and will not bear so well any subsequent action of soap, &c. A derivative from purpurine, called purpureine, has recently been obtained by allowing a solution of ammonia, water and purpurine, to stand for some time, occasionally supplying the loss of ammonia and water by evaporation, by adding fresh liquid. A substance separates of its own accord, which dyes unmordanted silk and wool, rose color.

Rubiacine.—Crystallizes in greenish yellow lustrous scales or needles. It volatilizes over heat and yields a yellow crystalline sublimate. It is soluble in boiling alcohol, but is deposited when the solution cools. *It is not decomposed by boiling nitric acid.*

Caustic alkalies generate it a purple solution; earth and metallic oxides, red. Treated with a boiling solution of pernitrate or perchlorate of iron it dissolves entirely in a brownish red solution, which, when cold precipitates by excess of hydrochloric acid a flocculent yellow sediment, which is rubiacic acid.

In madder there are also two amorphous *resinous coloring matters*, which have been called *Verantine* and *Ruboretine*, which exert a prejudicial rather than a beneficial effect, during the processes of madder dying. In fact, their action has to be counteracted.

Pectin appears to be a constituent quite indifferent to the dyer, unless as far as its facility for passing into *pectic acid* is concerned, when it might exert a bad influence, by destroying the attractive powers of the mordants.

The extractive matter, which when pure, looks like a yellow syrup, has scarcely any effect, since its solution is not precipitated by bases or earths, except that at a high temperature especially, it combines with the oxygen of the air, and forms a brownish solution, which then *can* be precipitated by sugar of lead. The solution of extractive matter in water, if treated with sulphuric or hydrochloric acid, becomes green; hence the matter is sometimes called Chlorogenine or Rubichloric acid.

This extractive matter mixed with the *bitter principle*, has been called *Xanthin.*

This bitter principle has been the subject of much discussion and experiment: it has been supposed to be the origin of all the other coloring matters, by undergoing certain processes by natural causes, as yet unexplained. An admirable account will be found in DR. URE'S Dictionary, Vol. III., p. 9. The enquiry was excited by observing that the root as it grows contains none of the above well-defined principles, but a certain yellowish extract; and also by the fact that madder improves by keeping up to a certain time, and by exposure to the air.

In dyeing with madder, it is necessary that the water used should be calcareous, or made so by adding a little lime. The lime combines and mixes with those constituents of madder that are injurious, and allows the alizarine to act freely.

The new principle that is contained in the madder of Khurásan and the Himálayan valley, is as already stated, *Munjestine;* and this substance has been made the subject of minute investigations by DR. STENHOUSE, which are recorded in the "Proceedings of the Royal Society of Great Britain," Vol. XII., p. 633, and Vol. XIII., p. 145.

Munjestine was obtained by boiling "manjit" in a solution of sulphate ammonia, repeatedly, until all the munjestine was extracted.

It is precipitated from the aqueous solution by bromine water, and the precipitate dried, if carefully heated, can be sublimed into beautiful golden lustrous scales and crystals, in the shapes of broad flat needles. It is convertible by the action of nitric acid, into phthalic acid, like purpurine and alizarine. A most beautiful orange-colored precipitate is obtained by mixing the watery or alcoholic solution of munjestine and acetate of lead. A slight excess of lead makes the precipitate scarlet.

The following extract from the "Proceedings" alluded to, shows the results of a comparison of "manjit" and European madder.

PROFESSOR RUNGE stated, in 1835, "that munjeet contains twice as much available coloring matter as the best Avignon madder. This result was so unexpected, that the Prussian Society for the Encouragement of Manufactures, to whom PROFESSOR RUNGE'S memoir was originally addressed, referred the matter to three eminent German dyers, MESSRS. DANNENBERGER, BÖHM AND NOBILING. These gentlemen reported, as the result of numerous and carefully conducted experiments, that so far from munjeet being richer in coloring matter than ordinary madder, it contained considerably less. This conclusion has been confirmed by the experience of my friend, MR. JOHN THORN, of Birkacre, near Chorley, one of the most skilful of the Lancashire printers.

"From a numerous series of experiments I have just completed, I find that the garancine from munjeet has about half the tinctorial power of the garancine

made from the best madder, viz., Naples roots. These, however, yield only about 30 to 33 per cent of garancine, while munjeet, according to my friend, MR. HIGGIN, of Manchester, yields from 52 to 55 per cent. Taking the present prices therefore of madder at 36 shillings per cwt., and munjeet at 30 shillings, it will be found that there will be scarcely any pecuniary advantage in using munjeet for ordinary madder dyeing. The colors from munjeet are certainly brighter, but not so durable as those from madder, owing to the substitution of purpurine for alizarine. There is, however, great reason to believe that some of the Turkey red dyers are employing garancine for munjeet to a considerable extent. When this is the case they evidently sacrifice fastness to brilliancy of color. By treating such a garancine with boiling water, and precipitating by an acid in the way already described, its sophistication with munjeet may very readily be detected. The actual amount of coloring matter in munjeet and the best madder is very nearly the same; but the inferiority of munjeet as a dye stuff results from its containing only the comparatively feeble coloring matters, purpurine and munjestine, only a small portion of the latter being useful, whilst the presence of munjistine in large quantity appears to be positively injurious. So much is this the case, that when the greater part of the munjestine is removed from munjeet garancine by boiling water, it yields much richer shades with alumina mordants than before."

An application of madder has been made to the preparation of *Garancine*. The process appears so valuable, that it might be carried out in the Punjab. An account of the method is extracted from DR. URE's Dictionary, Vol. III.

"It was supposed by ROBIQUET, that by the action of sulphuric acid on madder, the saccharine, mucilaginous, and extractive matters of the root were destroyed, and thus hindered from producing any injurious effects in dyeing, and that the woody fibre was at the same time charred, so as to prevent it from attracting and binding any of the coloring matter. This explanation is not entirely correct, since it is not necessary to carry the action so far as actually to carbonise any of the constituents of the root, and it is also doubtful whether the woody fibre ever attracts the useful coloring matters in any considerable degree. The account above given of the chemical constitution of madder, may easily lead us to the conclusion, that, during the action of the acid, the following processes take place:—1, The bitter principle or color producing body of the root is decomposed, yielding among other products, a quantity of alizarine, which did not previously exist; 2, The red coloring matters are rendered by the acid insoluble in water, and, thus it becomes possible to wash out the extractive matter, sugar, &c., without the madder losing any of its tinctorial power; 3, The lime, magnesia, and other bases which are combined in the root with coloring matter, or would combine with it during the dyeing process, are removed by the acid, and thus prevented from exerting any injurious action. The subsequent addition of a suitable quantity of lime, soda, or other base, serves to neutralise the effect of the excessive amount of pectic acid and resinous coloring matters, which were set free by the action of the mineral acid.

"The method of manufacturing garancine, as practised at the present day, may be shortly described as follows:—The ground madder is mixed with water, and the mixture is left to stand for some hours. During this time it is probable that the rubian is decomposed by the ferment of the root, otherwise, a great loss would be experienced. More water is now added, in order to remove all the soluble matters, and is then run off. The liquid contains sugar, and is employed on the Continent for the preparation of a kind of spirit, which, on account of its peculiar smell and flavor cannot be consumed as a beverage, but is used in the arts for the preparation of varnishes and other purposes. A sufficient quantity of alcoholic spirit is thus obtained to pay for the whole cost of the process. The residue left after washing the madder may be employed for dyeing without any further preparation, and is then called 'fleur de garance.' In order to convert it into garancine, it is mixed with sulphuric acid, and the mixture is heated and left to itself for some time. Water is then added in successive portions until the excess of acid is removed. The pectic acid of the root always retains a portion of the sulphuric acid in chemical combination; and the compound being but little soluble in water, would require for its removal a very long washing. The addition of a small quantity of carbonate of soda, by neutralising this double acid, serves to abridge the time of washing very considerably. The residue is then filtered on strainers, pressed, dried, and lastly, ground into a fine powder. This powder has a dark reddish brown color, and a peculiar odour, different from that of madder, but no taste. It communicates hardly any color to cold water. Dyeing with garancine is attended with the following advantages:—1, The whole tinctorial power of the madder is exerted at once, and garancine is therefore capable of dyeing more than the material from which it is made; 2, The colors produced by its means are much brighter than those dyed with madder, and the parts of the fabric destined to remain white attract hardly any color, so that very little treatment is required after dyeing; 3, Much less attention is required in regard to the temperature of the dye-bath and its gradual elevation

than with madder, and a continued ebullition produces no injurious affects, but only serves to exhaust the material of all its coloring matter. On the other hand, garancine colors are not so fast as madder colors, they do not resist so well the action of soap and acids, and hence garancine cannot be employed for the more permanent colors, such as pink and fine purple. By the use of a product which was patented by PINCOFFS and SCHUNCK several years ago, and which is obtained by exposing garancine to the action of steam at high pressure, it is indeed possible to dye as beautiful and as permanent a purple as with madder, and its use is attended by a considerable saving of time, as well as of dyeing material and soap, but it is not so well adapted for dyeing pink. As yet, therefore, we have not succeeded in obtaining a preparation which shall serve as a perfect substitute for madder, and the latter, consequently, continues to be employed for some purposes."

The samples of madder exhibited were from—

(4478) Jálandhar.
(4530) Amritsar.
(4558) Lahore.
(4642) Dera Ismaíl Khán.
(4648) Dera Ghází Khán.
(4658) Peshawur.
(4665) Kashmír.

All these were imported from Kandahár. One indigenous specimen was sent by the REV. MR. JAESCHKE from Lahaul (4507); only one sample came from the bazars of Kangra and Simla, though madder is to be obtained there; it is, however, seldom, if ever, exported from these places to the plains. The madder mostly goes to Múltán, and thence is dispersed over the country.

1668.—[4450]. "Al," root of *Morinda tinctoria*. Philibít. LOCAL EXHIBITION COMMITTEE OF GURGAON.

This is a root allied to the species of *Rubia*, and gives a red dye; as do also *Morinda augustifolia, citrifolia*, &c., in Central India.

In the Deccan, the "chay" root, *Hedyotis umbellata*, is celebrated. A sample was sent from Madras.

It is the "chay" root that is said to have been used in the original process of dyeing what is called Turkey red, but now the cotton fabrics dyed in this way are all imported from Manchester and Glasgow.

In the Madras Presidency, a process very similar to the Glasgow process is in vogue: and as the same style of dyeing can be practised with madder, the process appears of sufficient importance to be noticed here. The account is copied from the Appendix to the Madras Jury Report on Dyes, at the Exhibition of 1857.

Red.—Native process for dyeing red with "chay" root, calculated for 1 viss (or $3\frac{1}{8}$ lbs.) of white twist—

Take of sweet oil, ...	6	pollums
Ashes of the milk hedge (*Euphorbia antiquorum*), ..	6	„
Sheep's dung, ...	3	„

mix and keep in an earthen vessel for the space of four or five years, the older it is the better. Then when about to commence the process of dyeing, to the above mixture add

Fresh ashes of milk hedge, ..	8	measures
Spring water, ...	4	„

mix and strain and add to the strained fluid, shake the whole well together, and then add

Sweet oil, ...	15	pollums
Sheep's dung, ...	15	„
Spring water, ...	1	measure

mix the whole in a vessel. Then steep the twist in it for an hour, pressing and squeezing it well with the hands to cause it to absorb the fluid fully, after which leave it to soak. On the following day remove the twist and dry it in the sun. Then take in a vessel afresh

Ashes of milk hedge,.. ..	6	measures
Spring water, ...	3	„

mix and strain, and add to the strained fluid

Sweet oil, ...	15	pollums

Shake the whole well together and steep the thread in it for an hour, using the hands as before described, leave it to soak all night. Next morning take out the thread and dry it in the sun. In the evening of the same day take in a vessel afresh

Ashes of milk hedge,.. ..	6	measures
Spring water, ...	3	„

mix and strain, to which water add

Sweet oil, ...	$7\frac{1}{2}$	pollums

steep the thread in the mixture, using the hands as before and leave till next morning. Then remove and dry in the sun. Next take afresh

Ashes of milk hedge,.. ..	3	measures
Sweet oil, ...	$3\frac{3}{4}$	pollums
Spring water, ...	3	measures

mix and steep the thread, using the hands as before, and leave it soaking until next morning, when remove and dry in the sun, take afresh

Ashes of milk hedge,.. ..	3	measures
Sweet oil, ...	$3\frac{3}{4}$	pollums
Spring water, ...	3	measures

mix and steep in as before until next morning, then take afresh

Ashes of milk hedge,.. ..	$1\frac{1}{2}$	measures
Sweet oil, ...	$1\frac{7}{8}$	pollums
Spring water, ...	$2\frac{1}{4}$	measures

mix and follow the process as before, and take afresh

Ashes of milk hedge, ..	..	1	measure
Sweet oil, ...	..	15/16	pollums
Spring water, ...	..	2	measures

mix and follow the process as before, then take afresh

Ashes of milk hedge, ..	..	½	measure
Sweet oil, ...	..	½	pollum
Spring water, ...	..	2	measures

mix and follow the process as before, dry the thread for three days in the sun; on the foruth day take afresh

Ashes of milk hedge, ..	..	3	measures
Sweet oil, ...	..	2½	pollums
Spring water, ...	..	3	measures

mix and follow the process as before, but dry the thread in the *shade* the same night. Then take afresh before noon next day

Ashes of milk hedge, ..	..	1½	measure
Sweet oil, ...	..	1¼	pollum
Spring water, ...	..	2	measures

mix and strain, then steep the thread in the strained fluid a whole day and night, remove the thread next day, and expose it in the sun for four days. Then leave the thread untouched for a whole month, and after the expiration of that period, expose it for a day to the sun. On the day following wash the twist in pure spring or river water, and on the evening of the next day, take in a vessel afresh

Spring water, ..	10	measures	mix
Pounded "alli" leaves,	4	"	and add
Powder of "chay" root,	1½	"	

mix the whole, steep the thread in the mixture, using the hands as before, and leave to soak for the night. On the following morning, wash the thread in pure water and leave to dry.

The above process to be repeated afresh for the seven following evenings, omitting the "alli" leaves after the first two days. On the 8th day, in the morning, allow the thread in the mixture to boil, say from 4 to 8 P.M., then remove and keep the thread in the vessel *covered* until next morning, when remove the thread and wash it in pure water, leaving it to dry in the shade for a whole day. Repeat the washing and drying for the four following days. On the fifth day take afresh

Ashes of milk hedge, ..	..	3	measures
Spring water, ...	..	3	"
Sheep's dung, ...	..	3	pollums
Sweet oil, ...	..	2½	"

mix, steep the thread, using the hands as before, and then take it out to dry. A similar course must be followed for the three succeeding days, then keep it quite one day; on the following day wash the thread in good water, and leave to dry, all next day, then take afresh

Powder of "chay" root,	..	5	pollums
Spring water, ...	..	10	measures

mix, steep the thread, observing the same process as before, next morning remove the thread, and wash it in good water, and leave to dry, following a similar course for three days; then keep the thread quiet for ten days, after which take afresh

Ashes of milk hedge, ..	..	3	measures
Sweet oil, ...	..	2½	pollums
Spring water, ...	..	3	measures

mix, steep the thread, observing the same course as before, and leaving it till next day, then dry it in the shade, and follow the same procees three days, then leave it for ten days, after which wash in good water, and take afresh

Powder of "chay" root,	..	5	pollums
Spring water, ...	..	8	measures

mix, steep the thread in the mixture, using the hands as before, and dry in the sun next morning. Repeat the same the three following days, then on the succeeding morning wash the thread well in good water and when dry, it will have attained a beautiful fast red color, ready for weaving purposes.

1669.—"Bakm," sappan wood (*Cæsalpinia sappan*); also called "vakm," and "patang."

A colored wood, imported almost exclusively from Bombay. It yields pinks and reds, and lilacs, but not permanent.

Samples are sent from—

(4451) Gurgaon (this comes however from Philibit).
(4484) Jálandhar.
(4531) Amritsar.
(4562) Lahore.

The Brazil and Nicaragua woods, used in making red ink, are allied species.

1670.—[4509]. Kuámé, a red dye, from Lahaul. REV. MR. JAESCHKE.

This is a black tapering root like a parsnip, with rough glabrous leaves, and is referred to *Onosma echioides*. Is very like the allied genus *Anchusa*. It is used medicinally for wounds and diseases of the blood, and in certain religious ceremonies. Not officinal in Lahaul as a dye.

From Madras was exhibited a lilac red ink of pleasing color, from species of prickly pear, and a pot of a concrete red dye obtained from the same; and a specimen of the "chay" root (*Hedyotis umbellata, Oldenlandia umbellata*).

1671.—[ ]. Kussumba, "gul-i-másufir," safflower, bastard saffron (*Carthamus tinctorius*).

This dye is grown for local consumption in several districts, but the best comes from the hills. The

city of Dínanágar, in Gurdaspúr, is celebrated for its "kussumba" dyes; and excellent "kussumba" is grown in the submontane portions of Kangra, Gurdaspúr, and Hushyarpúr: the hill safflower is quite the best.

The Lahore dyers acknowledge three kinds—the first distinguished by the bright clear color of the flowers, his is "pahári." The second is "Hushyarpúrí;" and the third "Gujrátí." "Kussumba" is sold both powdered and unpowdered. In Bengal the flowers are steeped in water till all the first, or yellow coloring, matter is extracted: and then the flowers being ready to give the second, or valuable red coloring matter, are compressed into cakes and dried.

It is much to be regretted that science has hitherto failed to produce any substance capable of fixing the beautiful tints of the safflower. Consequently, articles dyed with the flower will alter and fade after a time in the light.

In Europe a species of rouge is obtained by precipating an impalpable powder from the solution of safflower; in this country, pinks and reds are produced of all shades, from the pale "piyazi" or pinkish white, to "gulábí," bright pink, and to the crimson, "gul-i-shaftalú" color.

Samples of "kussumba" are sent from the following districts:—

(4440) Delhi (powdered and unpowdered).
(4447) Gurgaon.
(4457) Rotak.
(4460) Ambálah.
(4472) Bhajji of Simla.
(4468) Ludhiana.
(4496) Kangra.
(4479) Jálandhar.
(4526) Amritsar.
(4459-61) Lahore (of the three varieties just noticed).
(4587) Gujranwalla.
(4609) Jhilam.
(4620) Gugaira.
(4635) Jhang.
(4637) Muzaffargarh.
(4641) Dera Ismail Khán.
(4649) Dera Ghází Khán.
(4654) Bunnoo.
(4661) Peshawur (from Kábul).
(4662) Kapúrthalla.
(4679) Jhínd.
(4681) Nabha.
(4684) Pattiala.

1672.—Harsinghár, the flowers of *Nyctanthes arbortristis.*

Grows on some of the hills, and is used for dyeing, silks especially; it produces a good yellow color, and compounds with reds, into a pleasing series of flame, salmon, and orange colors.

Samples came from—
(4439) Delhi.
(4443) Gurgaon (Jharsah).
(4462) Ambálah.
(4619) Gugaira.
(4685) Pattiala.

1673.—Phúl tún, flowers of *Cedrela toona.*

Also yield a yellow dye of little permanence.

The samples are from—
(4465) Ambálah.
(4499) Kangra.
(4527) Amritsar (imported).
(4549) Lahore.
(4586) Pattiala.

1674.—"Gul kesu," flowers of the dhák or palás tree *(Butea frondosa).*

These are large papilionaceous yellow and orange flowers, having a very handsome appearance: there are in parts of Karnál whole jungle tracts covered with this tree, and the masses of flowers must present a brilliant appearance. The flowers are ground into powder to make the "roli," or colored powder which Hindús throw at one another during the "holi," or spring festival; or are boiled, and the color extracted and precipatated for the purpose. The color, as a dye, is bright, but not fast. Specimens scarcely differing in appearance were sent from—

(4458) Rohtak.
(4461) Ambálah.
(4491) Jálandhar.
(4498) Kangra.
(4588) Gujranwalla.
(4591) Gujrát.
(4606) Jhílam.
(4613) Shahpúr.
(4613) Gugaira.
(4650) Dera Ghazí Khán.
(4664) Kapúrthalla.
(4677) Kashmír.

1675.—"Aswarg" or "asbarg," "isbarg."

Is a yellow dye, being the stalks and flowers of a species of *Delphinium.* It is almost exclusively used in dyeing silk, to which it gives a fine yellow, not permanent. The dye is exclusively imported from Khurasán and and Kábul.

(4528) Amritsar.
(4657) Peshawur.
(4555) Lahore.

1676.—[ ]. Saffron, the stigmata of the flowers of *Crocus sativus.*

Samples are sent from Kashmir and from Dera Ismail Khán (4640), which last is probably imported from Kandahár and Persia, where saffron is largely grown. "Bakiri" saffron comes from Kandahár. The plant is more used in confectionery and medicine than in dyeing.

The following extract describes the cultivation in Kashmír :—

"Pampur, a large village on the right bank, is celebrated for its saffron grounds. The cultivation of the flower is carried on in nearly every part of this pergunnah, the local soil being alone found suited for the purpose: it appeared to consist of a light ferruginous clay, which is excavated near the Jhilam, and carried to the fields by great manual labor. The bulbs are planted out in small square beds in June, weeded and freely irrigated, and the crop is collected in October. The MAHARAJA and his myrmidons attend the gathering, and take the *spolia opima* of the occasion. The drug is sold in the royal bazar: and I was informed that 1 rupee per seer was levied as an export duty on the trade. It varies in price according to quality: I observed some as low as rupees 5 the seer of 2 lbs., but this was mixed with very ancient stuff or what was worse, the *dried petals* of the flower. True saffron (*under royal warranty*) fetches from 7 to 10 rupees per seer, in Kashmír coin, which is little more that half the "Company's." Steeping the article in water previous to weighing out is commonly practised, and which, in addition to increasing weight, injures its coloring properties irretrievably. Sometimes the unwary Hindústání merchant packs it in this damp state, and on reaching the plains discovers, to his great sorrow, that the precious purchase has become a mass of mouldy rubbish, unsaleable at a pice."*

1677.—[4476]. Berberry (*Berberis aristata*). Simla. MR. GEO. JEPHSON.

The wood yields a yellow principle, which is called berberine. This is also the "yellow wood" of the Bunnoo collection, from the Waziri hills (4655). There is an interesting paper on this product by PROFESSOR SOLLY, extracted in Vol. III. of A. H. Society's Journal; the early volumes of the series are so rare, that I have reproduced the paper *in extenso.*

On the yellow color of the Barberry, and its uses in the Arts. BY E. SOLLY, ESQ.—"Having learnt, whilst engaged in enquiries amongst manufacturers and other practical men, that the root of the common barberry (*Berberis vulgaris*), was an article of increasing value in the arts, on account of the fine yellow color which it contains, and that a new source of this dye stuff was rather a desideratum, I was led to inquire in how far the root in question could be advantageously obtained from India.

"The most important use to which the coloring matter is applied, is, as I am informed by a gentleman well acquainted with the arts of dyeing, for the purpose of dyeing or staining leather yellow, for which purpose it is found peculiarly well suited.

"The coloring principle is found in the bark and wood of the stem, as well as in the root; but the root only has, I believe, been applied in dyeing. In the specimens which I have seen, the coloring matter was in the stem for the most part collected together in the bark, and round the circumference; a considerable portion, also, was deposited round the pith, particularly in the larger stems; whilst the great bulk of the woody fibre intervening, contained very little color. The root, however, was wholly of a fine yellow color.

"The gentlemen, before mentioned (and to whom I am indebted for much useful information on this subject), informs me, that the barberry he has seen was generally in large straight pieces, having a somewhat honey-comb cellular structure, and that the color was generally collected together as it were in masses.

"In the larger stems, the proportion of useless woody fibre to the bark and parts yielding color, is undoubtedly large, but this is quite compensated by the superior richness of color in the old stems.

"According to some experiments of MM. BUCHNER and HERBERGER, which are detailed in the 'Journal de Pharmacie,' the root of the *Berberis vulgaris* contains rather more than 17 per cent. of yellow coloring matter, which is entirely soluble in hot water, and to which the name of berberine has been applied. The root, besides this, contains gum and many other substances, but it is the berberine alone which is available for the purposes of the dyer.*

"Few natural orders are more widely distributed than the *Berberideæ*, for they are found in most temperate parts of the globe: species are found in most of the countries of Europe; and extend, as DE CANDOLLE has observed, from Candia to Christiania. In Asia, they are, perhaps, even more widely diffused

* "Natural Productions of Kashmir." LIEUT. LOWTHER, Journ. As. Soc. VIII., p. 224.

* This color has been long used in Astrachán and Poland as a dye for leather, and in some parts of Germany, for staining wood of a bright yellow color.

and abundant. The best known varieties of Asiatic barberries are—

"1. *Berberis Siberica.*—A small shrub found on the lower mountains and rocky hills of Altaic Siberia.

"2. *Berberis sinensis.*—Which abounds in China, and the northern parts of India.

"3. *Berberis Wallichiana.*—A native of Nepal.

"4. *Berberis floribunda.*—This plant, which is common in the whole of the North of India, was formerly thought by DR. WALLICH to be identical with *Berberis aristata*; it is now, however, known to be different.

"5. *Berberis Asiatica.*—Abundant in Nepal and Kumaon; and according to DE CANDOLLE, the *Berberis tinctoria*, which flourishes in the Neelgheeries, is identical with this species.

"6. *Berberis aristata.*—Perhaps the most widely diffused of all these species. It abounds in the mountains of Northern India, and extends from the Himalaya mountains to the Neelgheeries, and as far south as Nuera Ellia, and Adam's Peak in Ceylon. It has been described in the 'Botanical Magazine,' under the name of *Berberis chitra*; it is, however, not the same as the *Chitria* of Nepal, which is another variety of *Berberis*.

"Many of these species live for a long series of years, and attain very considerable size; according to DR. ROYLE, *Berberis Nepalensis*, a most beautiful species, which inhabits the mountainous districts in the North of India, grows in shady places to the height of 12 feet, at elevations of from 5 to 6,000 feet above the level of the sea; and M. LESCHENAULT DE LA TOUR states, that the *Berberis tinctoria*, which flourishes in the Neelgheeries, and is there known by the name of 'jakalow,' attains a height of even 20 feet.

"These different species of *Berberis* are employed by the natives in the districts where they abound, in medicine, and as a dye; and the fruit of some are dried and used as an article of food. The late GENERAL T. HARDWICKE, in his 'Narrative of a Journey to Sirinagar,' published in the 'Asiatic Researches,' relates that a variety of *Berberis* is abundant in the valley through which the Koa Nullah has its course; the fruit of this variety is eaten by the natives, and the wood, which is of a bright yellow color, is used by them for dyeing, but from the imperfection of their processes the color so obtained is not permanent. DR. ROYLE, in his 'Illustrations of the Botany and Natural History of the Himalaya Mountains,' says, when describing the properties and uses of the *Berberidaceæ*. 'The root and wood of one species, the *Berberis aristata*, being of a dark yellow color, and forming the 'dar huld' of Persian writers, are used as a dye; and being bitter and a little astringent, are, together with the bark, employed in medicine.' The variety of *Berberis* found in the Neelgheeries, and which M. LESCHENAULT DE LA TOUR calls *Berberis tinctoria*, from the use to which it has been applied, has by the experiments of MR. VAUQUELIN, been found to be inferior to few woods, for dyeing a yellow color.

"There being fortunately preserved in the Museum of this Society, a small quantity of barberry root, which had been sent from Ceylon, together with other specimens of dye woods, &c., I have been enabled to make some experiments with its coloring matters, the result of which proved that it was quite as abundant in the Asiatic as in the European barberry; and on comparing it with some root from Cologne, I found that the color from the Asiatic was even finer and more brilliant; and from some experiments in dyeing cotton and silk with it, I have no doubt that it will be found, if not superior, at least quite equal to the very best which has hitherto been obtained from Cologne, Hamburg, and some other European towns.

"Experiments should be made as to the relative quantity and quality of color contained in the old and young trees, and in their wood, bark, and roots respectively, and likewise as to the best time for collecting them.

"As the root contains only about 17 per cent. of useful coloring matter, and the remainder consists of woody fibre and other matters not useful to the dyers, it is important to inquire into the possibility of substituting for the wood or root a watery extract of them. This would contain the whole of the coloring matter, and whilst it would present it in a condensed and convenient form, would of course greatly diminish the expense of carriage and freight, and, in consequence, reduce the ultimate cost of the color.

"It is evident that there would be no great difficulty to prevent this being done, for the natives prepare extracts with great success, and have considerable experience in such operations, as we see from a number of Indian extracts, such as "kath" and *Terra japonica*, which have lately become important articles of trade. But there would be far less difficulty in obtaining the extract of barberry, than that of many other trees, for the natives have long made and used it themselves as a medicine; and it is described in the Asiatic books on Materia Medica, under the name of 'rusot,' 'hoozis,' and 'huzuz.' There can therefore be no difficulty in obtaining the article in any quantity which may be required.

"It has long been remarked, as a curious circumstance, that DIOSCORIDES has made no mention of the barberry, which, from its wide diffusion and remarkable properties, could hardly escape the attention of

the early naturalists. This has, however, been explained by Dr. Royle, who has adduced the most unexceptionable evidence to prove that the Lycium of the ancients, or Λύκιον of the Greeks, was really identical with the 'hoozis' of the present day, and was in fact, an extract of barberry. A very interesting confirmation of this will be found in Avicenna, who, when speaking of Lycium, says it is the extract of 'Al-Feluzhargi;' and Dr. Royle, in his paper on Lycium, informs us, that the Persian name of 'rusot,' the extract of barberry, is 'Feelzurch.'

"Some little confusion is caused by the term 'dar huld,' or yellow wood, being applied to more than one plant; thus, among many others, Playfair, in his translation of the 'Talif Sherif' describes 'dar huld' as turmeric, and says, it is pungent, bitter, hot, and dry, a description applicable to turmeric, but not at all to barberry, which is usually described as bitter, cooling, and slightly astringent; and Dr. Royle informs us, that in the North of India 'dar huld' signifies barberry, and that on asking to see the plant yielding 'dar huld' and 'rusot,' species of *Berberis* were pointed out; whilst in the South of India it is only applied to turmeric.*

1678.—Ekal bir, roots of *Datiscus cannabinus.*

Exclusively a hill product, and used in dyeing silk pale yellow, it is also an ingredient in producing a pleasing pale "pista green."

A specimen is sent from

(4505) Kangra.
(4676) Kashmir.
(4481) Jálandhar.

1679.—[4606]. Akás bel *(Cuscuta reflexa).* Jhilam. Local Committee.

This plant is a thread-like parasite, often hanging over bushes; it is only occasionally used in dyeing.

1680.—Kamíla. The red powder from the capsules of *Rottlera tinctoria.*

Hill produce.

Samples are sent from—

(4470) Ludhiana.
(4500) Kangra.
(4543) Amritsar.

1681.—Turmeric, (*Curcuma longa*); "haldi;" "zardchob."

For an account of this plant, *see* under "Spices and Condiments." The sorts that are best for dyeing are less good for eating, and *vice versâ.* Turmeric is liable to instant discoloration by all alkalies, of which it is a test, hence it is a bad and impermanent dye stuff.

Samples of the dye were sent from—

(4497) Kangra.
(4529) Amritsar.
(4537) Lahore.
(4614) Dera Ismail Khán.
(4656) Bunnoo.

1682.—Mendhi or barg-i-haná *(Lawsonia inermis).*

Used rather as a dye for the beard and hair, and for fingers, and for horses' tails, than as a fabric dye.

Some classes of Mahomedans esteem red hair a great beauty, and dye with "mendhi" accordingly; if a black hair dye is required, "mendhi" with myrtle berries is first applied, and over that indigo, producing a purple-black. The practice of staining the finger nails with this drug is not uncommon among women. The best "mendhi" comes from Gujranwalla.

Samples are sent from—

(4463) Ambálah.
(4554) Lahore (tahsil Chúnyán).
(4589) Gujranwalla.
(4615) Shahpúr.
(4687) Pattiala.
(4449) Gurgaon.

Memorandum on the cultivation of the "mendhi" plant (Lawsonia inermis). By Major W. G. Davies, Deputy Commissioner of Shahpúr.—"This plant, so often seen in our gardens as an ornamental hedge, is extensively cultivated about Bhera, in the Shahpúr district, for the sake of the dye extracted from its leaves, which, dried and reduced to powder, forms a regular article of commerce. The mode of cultivating it here is as follows:—The soil is prepared by repeated ploughings not less than sixteen, and heavy manuring. Before sowing, the seed is allowed to soak in water for twenty-five days. It is then spread on cloth and allowed to dry partially. The plot of land in which it is proposed to grow the 'mendhi,' is then formed into small beds, and some days before sowing these, are kept *flooded.* The seed is scattered on the surface of the water, and with it sinks into the ground. For the first three days after sowing, water is given regularly night and morning, after that only once a day. The young plant first shows above ground on the fifteenth day, after which water is only given every other day for a month, when it is supplied at intervals of three days, and this is continued for another month, by which time the plants have become nearly two feet high. They

* "Journal of the Royal Asiatic Society of Great Britain and Ireland," No. XIII.

are now fit for transplanting. The mode of conducting this operation is as follows:—The young plant on being taken out of the ground is reduced by nipping off about six inches from the centre shoot. After having been subject to this treatment, the young plants are singly put into holes previously dug for them at distances of about a foot from each other. They are then watered daily until they have recovered the shock of transplanting, and afterwards as they may require it. The fields are weeded regularly once a month. The first year nothing is taken from the plants, but after that they yield for years, without intermission, a double crop. At each cutting, about nine inches is taken from the top shoots of the plants. The two crops are gathered in Baisakh (April and May) and Katak (October and November) of each year. The laborers employed in planting out the *mendhi*, instead of receiving their wages in money, are liberally fed as long as the operation lasts, and a distribution of sweetmeats takes place when it is over. The season for sowing is during the month of Baisakh, that of transplanting, Sáwan (July and August). A year's produce of an acre of well grown 'mendhi,' is twenty maunds of dry leaves, of which about six maunds are gathered in the spring, and the rest during the autumn months; and the same plants continue to yield for twenty or twenty-five years.

"The selling price of the leaves averages a rupee for twelve seers, so that the value of the crops per acre is about 66 rupees. After the first year, the expenses of cultivation do not much exceed those of other crops. The produce of the 'mendhi' grown in this district is nearly all carried across the Jhilam, and sold in the northern districts, none of it finds its way to the south. Besides, the use to which the leaves are ordinarily put, viz., as a dye for the hair, hands, &c., they are also given to goats and sheep, &c., when attacked by itch."

1683.—[4536]. Gul-i-zard. Amritsar. LOCAL COMMITTEE.

I have no information respecting the Botanical origin of the flower.

1684.—[4607]. Harmal *(Peganum harmala)*. Jhilam.

Used in dyeing black. The seeds of this plant are attracting attention in Europe as a brown and black dye. The plant grows everywhere on waste broken ground in the Punjab, and might be collected at a very cheap rate, except perhaps as regards carriage; but the subject wants attention.

The next series are those vegetable (1) astringents, and (2) acids, which are used as brighteners and mordants. The mineral ones, the principal of which are alum, and the varieties of "kahi" have been referred to in the Mineral Department (*see* also the Jury Report).

1685.—Naspâl, rind of the pomegranate *(Punica granata)*.

Besides its astringency, this is itself used alone as a dye, giving a somewhat feeble yellow. The bark of the tree "post anár" is also powerfully astringent, but is not common enough to be much in use as a tanning agent.

Samples were sent from—
(4445) Gurgaon (Jharsah).
(4456) Rohtak.
(4483) Jálandhar.
(4561) Kangra.
(4533) Amritsar.
(4557) Lahore.
(4610) Jhilam.
(4614) Shahpúr.
(4618) Gugaira.
(4639) Muzaffargarh.
(4652) Dera Ghází Khán.
(4707) Pattiala.

1686.—Máín, galls of *Tamarix furas* and *T. dioica.*

These are used in dyeing with madder, the cloth being first steeped in a solution of the galls. They form also with "kahi," the salts of iron, various shades of "kháki" or gray, and darker shades, and up to black: they are also used in tanning.

They abound in all jungly districts where there are tracts of waste land covered with the tamarisk, as in Gugaira, Jhang, &c., &c. In Dera Ghází Khán, MAJOR POLLOCK mentions that 500 maunds were annually collected.

The dyers sometimes make a distinction between "máín bari" and "máín choti," but there is no reason to suppose there is any difference in the nature of the product, the only difference being in the size of the galls.

This must not be confounded with the "mainphal" (*Randia dumetorum*).

Specimens of "máín" were sent from—
(4445) Gurgaon.
(4490) Jálandhar.
(4541) Amritsar.
(4612) Shahpúr.
(4616) Gugaira.
(4639) Muzaffargarh.
(4651) Dera Ghází Khán.
(4634) Jhang.

1687.—[4670]. Májú. Srínagar. H. H. THE MAHARAJA.

The fruit or nuts of *Cupressus sempervirens*, or allied species. The Májúphal is *usually* a gall imported *viâ* Calcutta, and probably an oak gall: none of the Indian oaks have galls.

1688.—[4676]. Ráf (resin). H. H. THE MAHARAJA.

Used in dyeing wools of a silver and dove color.

1689 —[4669]. "Darengri." Srínagar. H. H. THE MAHARAJA.

The astringent leaves of a tree (*Rhus cotinus* or allied species?) used in dying with "kahi" to produce black and gray shades.

1690.—[4666]. "Dhoû patta," leaves of the *Conocarpus latifolius*. Jammú. H. H. THE MAHARAJA.

A sample was sent also from Kangra (4502).
The leaves are astringent.

1691.—[4671]. "Ushna," lichen (*Borrera ushna*). Srínagar. H. H. THE MAHARAJA.

Used in dyeing.

1692.—[4487]. Har (*Beleric myrobalan, Terminalia bellerica*). Jálandhar. LOCAL COMMITTEE.

These trees are extensively grown in the Kangra district of this division, and this district is probably the source of the sample.

MR. BARNES writes: "These trees are very valuable. The produce of a single tree will sometimes sell for Rs. 2,000. The "hur" flowers in May. The fruit ripens in October or September, and consists of a nut enclosed in a thin exterior rind. The rind is the valuable part. It is used as an aperient, and has also tonic properties calculated to promote digestion. It also forms a dingy yellow dye.

"The fruit is exported by traders from the plains, who generally contract for each tree, according to the produce it bears. The larger the fruit, the more active its medicinal qualities. One nut will sometimes sell for one rupee. The ordinary price however is ten or eleven seers for a rupee."

1693.—[4402]. "Balela sújah," small black *Myrobalan* (*Terminalia citrina*). Jálandhar. LOCAL COMMITTEE.

1694.—[4503]. "Añwlá patta." Kangra. LOCAL COMMITTEE.

The skin and rind of the *Emblic myrobalan* (*Emblica officinalis*).

1695.—[4506]. A'mlah leaves. Kangra. LOCAL COMMITTEE.

The leaves of the same tree.

1696.—[4510]. "Púrlú." Spiti. KANGRA LOCAL EXHIBITION COMMITTEE.

A substance used in dyeing black with "pasúta" (alum and sulphate of iron) as the mordant. It is the astringent twig of a tree.

1697.—[4510]. Nayálu. Spiti. KANGRA LOCAL EXHIBITION COMMITTEE.

An astringent: used in dyeing red and yellow.

1698.—[4544]. Boz gand, galls of *Pistacia terebinthus* or *P. cabulica.* Amritsar. LOCAL COMMITTEE.

Used in dyeing. They are brought from Kábul, &c.

ACID SUBSTANCES ADDED TO BRIGHTEN THE TONE OF DYES.

1699.—[4453]. "Am chúr," dried slices of unripe mangoes. Rohtak. LOCAL COMMITTEE.

A sample also was sent by—
(4489) Jálandhar.
(4494) Kangra.

1700.—[4454]. Limos (*Citrus medica*). Rohtak. COL. VOYLE.

These are used in dyeing with "kussumba." A sample of the juice was sent also from Kangra (4495).

1701.—[4493]. Galgal juice (*Citrus galgala*). Kangra. LOCAL COMMITTEE.

1702.—[4455]. Tamarind, "imlí" (*Tamarindus indica*). Rohtak. COLONEL VOYLE.

These are the fruits dried: they are very acid. This fruit is too uncommon to be of general use in dyeing.

1703.—[4484]. Kishtah.

These are dried pieces of unripe apricots, brought from the hills and from Kábul, &c. Its acid is used extensively in dyeing with "kussumba," but is also valued to make chutnies and pickles of. A sample was sent from Lahore (4550).

1704.—[4488]. Soap nut, harítha (*Sapindus emarginatus*). Jálandhar.

Used in dyeing and washing shawls, silks, &c.
(4672) Kashmír.

There are also in the dye list two unidentified names.

1705.—[4542]. Akbíj. Amritsar.

1706.—[4545]. Harkadi. Amritsar.

ARTISTS' COLORS.

The great majority of these are mineral: there are only two or three in the Vegetable Kingdom.

1707.—[4515]. Peori. Amritsar. LOCAL COMMITTEE.

This is a precipitate, collected and dried from the urine of cows, which have been fed on mango leaves. This "peori" is called "hardwári." "Wilayiti peori" is chrome yellow (chromate of lead).

1708.—[4524]. "Khún siáwashán," dam-ul-akhwain *(Ar.)* Amritsar. LOCAL COMMITTEE.

Dragon's blood, not from the *Dracæna draco*, but probably a *Pterocarpus*. The gum resin ground up yields a good transparent pink and red.

1709.—[4521]. Rola. LOCAL COMMITTEE, Amritsar.

This is an artificially colored powder made of the *Trapá bispinosa* flour, colored with "kussumba," and "kamela," &c.; it is used by Hindús during the carnival, or "huli" festival, to throw at one another.

Under this class were exhibited several samples of dyed threads, silks and woollens, as well as fabrics. There were one or two samples of calico, printed in colors, and in silver and gold; but the finest samples of prints were exhibited as manufactured fabrics, in the section devoted to textile goods.

1710.—[4442]. A book of dyed cloths was exhibited by the MUNICIPAL COMMITTEE, Delhi.

These dyes were as follows :—

Halki piyázi—pink, very pale.—Made with kussumba.

Piázi (onion)—pink.—Ditto.

Gulábí (rose)—bright rose color.—Ditto.

Gul-i-shaftalú (color of nectarine flower)—crimson (carmine).—Ditto.

Gulánár (color of pomegranate flower)—scarlet color.—Ditto, tinted with yellow dye.

Náringi (orange)—deep orange.—Ditto, with harsinghár.

Shingarfi—Cinnabar red, "Shingarfi" (mineral).

Kirmizi (kermes)—Dull red.—Said to be safflower with a trace of indigo.

Suneri (color of gold)—orange.—Made with kussumba and harsinghár in excess.

Champai (color of champa flower, *Michelia*)—orange (lighter)—Harsinghár.

Sharbati (color of wine)—salmon colored—Harsinghár and kussumba.

Basanti zarfishán—yellow, sprinkled with crimson.—Turmeric, with kussumba sprinkling.

Halka káfuri—almost white.—Harsinghár.

Kafurí (color of amber)—lemon yellow.—Ditto.

Basanti—bright yellow.—Turmeric.

Sewati—toad color.—Turmeric and indigo.

Múngyá—the same, slightly bluer tinge.—Turmeric and naspál.

Salgi—dark green.—Indigo and turmeric.

Kupási (cotton plant color)—pleasant pale green—Green extracted from English fabrics.

Dháni—full green.—Indigo and turmeric.

Surmai (antimony color)—dark blue; near black.—Indigo.

Asmáni—sky blue.—Ditto.

Nukrei (silver color)—pale silver blue.—Indigo and lemon rind.

Lájwardi—fine purple blue—Safflower and lajward. (This is a beatiful color, but so "kutcha," that it rubs off between the fingers).

Kásni (color of chicory flower)—lilac, with preponderance of pink.—Safflower and indigo.

Fálsái (*Grewia* flower color)—reddish lilac.—Ditto, different proportions.

Sosan (lily iris color)—puce.—Ditto.

Kokai—dull mauve or pale lilac.—Ditto.

Siyah bará—a fine black.—Pomegranate rind, kahi, &c.

Kishmishi (color of raisins)—warm brown.—Khatta and pomegranate rind, &c.

Sandli—(sandal wood color) paler ditto.—Ditto.

Máshi—deep brown—Alum, turmeric and pomegranate rind.

Dúdhiya kháki—dove color, pale.—Kíkar seeds and galls, &c.

Khákí—gray drab.—Pili mittí, naspál and galls.

A'gari—red brown.—Naspál, katth and galls.

Kákarneri—chocolate brown.—Ditto.

1711.—[4548]. Frame, exhibiting specimens of 60 dyes, and 12 printed calicoes. Prepared by NUR MUHAMMAD of Lahore.

The colors are those, the preparation of which was described at the commencement of this chapter. NUR MUHAMMAD is a very aged man, over 90 years, and has great repute among the natives of this city as the cleverest of dyers.

1712.—[4593]. Specimens of dyed cotton thread. GUJRAT JAIL.

Scarlet, purple, "gulabbási" lilac-red (color of *Mirabilis jalapa* flowers), "piyázi," "surmai," asmaní," "kásni," "khákí," "sabza" "marúli (shade of green), "sabza pistai" (color of pistacio nut, pale green), "zard" (yellow).

1713.—[4623-33]. Gugaira. Pak Pattan. LOCAL COMMITTEE.

Cloth—red.—Dyed with safflower.
Ditto—deep pink.—Ditto.
Ditto—pale pink.—Ditto.
Ditto—orange.—Dyed with safflower and *Nyctyanthes.*
Ditto—pale orange.—Ditto.
Ditto—red.—Ditto.
Ditto—purple.—Dyed with indigo and safflower.
Ditto—purple.—Ditto.
Ditto—deep purple.—Ditto.
Ditto—purple.—Ditto.
Ditto—green.—Dyed with indigo and turmeric.
Ditto—yellow.—Dyed with turmeric.

1714.—[10408]. A series of dyes, simple and compound, capable of being produced by shades and combinations of indigo, safflower and turmeric. Muzaffargarh. LOCAL EXHIBITION COMMITTEE.

PRINTED FABRICS AND BLOCKS.

1715.—[4442]. Cloths printed with silver and gold leaf. MUNICIPAL COMMITTEE, Delhi.

The pattern is first stamped on the cloth by a block charged with a gummy mixture, after this the tin, silver, or gold leaf is laid on, adhering wherever there is gum. When the whole is dry, the superfluous leaf is brushed off. There are some very pleasing specimens of this work among the articles of clothing from Kangra and Ambálah, but the process is rude, and the patterns, though often pretentious enough, do not come clear and well defined.

These stamped clothes are much worn on gala days by the hill people of Kangra, &c.

1716.—[10047]. Series to illustrate block printing, in madder of two shades, and black. Muzaffargarh. LOCAL COMMITTEE.

The blocks, being of hard blackish wood, the cutting of which is an express trade, accompany the samples.

The cloth to be printed is first steeped in a solution of tamarisk galls (máiñ). The 1st block, charged with a mixture of "kahi" (sulphate of iron), is stamped, and thus producing a pattern in black lines by the chemical effect of iron on the tannin in the galls. When this is dry the parts intended to be of a very deep red, are stamped in by a 2nd block, charged with a mixture of alum, and finely ground soapstone or ochre. When this mixture has dried on, the whole is boiled in the madder vat. The block pattern remains unaltered, but wherever the ochre and alum paste has been, the madder settles with a deep red; and wherever the plain cloth, merely stained with the galls has left, the madder issues a pale tint. The result of the whole is very pleasing at a distance; and cloths printed in this way are very cheap, but the process is rude in the extreme.

Some of the printed floor cloths and bed covers of Múltán, are very beautiful; they exhibit all that fertility of pattern-design, which natives are capable of. The fabrics will not of course wash—but verditer blue, black, turmeric, yellow, "kussumba" red, madder, &c., enter into the combinations of colored patterns employed.

A set of blocks and apparatus for calico printing were sent from Amritsar (10357).

A set of blocks for calico printing, used by the Thuggee School of Industry in preparing tent linings was sent (10383).

A set of very elaborate blocks, as a kind of shawl pattern, were sent by the Hushyarpúr Committee.

All these blocks are cut from a dark hard wood, the pattern standing out in high relief, the indentations being cut very deep.

REPORT ON SUBSTANCES USED IN DYEING.

CLASS IV. SUB-CLASS (C). SUBSTANCES USED FOR DYEING, INCLUDING CLOTHS DYED TO ILLUSTRATE THE PROCESS,—PRINTED FABRICS AND BLOCKS FOR PRINTING—ALSO ARTISTS' OR OTHER TRADES' COLORS, AND MORDANTS.

JURY.

DR. BROWN,	MR. R. E. EGERTON,
MR. F. E. GORDON,	MUNSHI HARSUKH RAI,
MR. R. H. DAVIES,	SARDAR JASSA SINGH.

REPORTER—MR. B. POWELL.

IN every nation the art of dyeing, however rudely and unscientifically practised, is to some extent known, provided the nation has reached a stage of advancement sufficient to produce something in the nature of a fabric, to receive the dyers color; and even before this stage, while as yet the people are mere savages, they readily discover those curious color-yielding plants which exist more or less in every climate, and of which the "woad" used by the ancient Britains to stain their bodies, furnishes a familiar example.

Perhaps no art has ever received more rapid or successful development than that of dyeing. While botanical science has worked in pointing out new plants yielding coloring principles, chemistry has been no less active in furnishing methods of fixing and brightening these coloring matters, in teaching us their affinities and attractions, and in educing from mineral sources fresh dyes. Witness, for instance, the recent discovery of "rosaline," from tar--yielding all those beautiful shades, known by the names of magenta, opaline, &c.

Chemistry is alluded to, because it is precisely in that branch of the art of dyeing wherein chemical knowledge comes into practice, that the dyeing of this country fails so conspicuously.

It was impossible to look at the large frames containing series of dyed cloths from Lahore and Muzaffargarh (4548 and 10408), and the book of dyed cloths from Delhi (4442), without noticing the large variety of tints that can be produced from the simple substances for the most part employed by native dyers; and yet, the number of these that are not fast is very large—some of them will not stand washing,—others will not stand exposure to light. For instance, the beautiful "kussumba" (*Carthamus tinctorius*) yields 6 or 7 distinct shades of red—the palest pink, or *piyázi*, *gulábi* (pink), *gulábi surkh* (rose color), *kulfi* or *gul-i-shaftalú* (deep red). Again, in combination with *harsinghár* flowers (*Nyctanthes arbortristis*), it yields *soneri*, or golden orange; *nárangi*, deep orange; and *sharbati*, salmon color; and with turmeric (*haldi*, *zard chob*), it gives a splendid scarlet, *gul-i-ánár*, and other tints; again, if combined with indigo, Prussian blue, &c., a series of beautiful purples,

known as *lájwardi, úda, náfarmání, sosani, kásni* (a delicate mauve), *fálsai, kokai,* and the deep purple, *baingni.* Now, all these tints are more or less beautiful, but scarcely one of them will stand washing. There is a great want of that series of substances known as mordants. The use of the salts of tin and lead is entirely unknown to native dyers. There is no known mordant that fixes safflower, hence all the scarlet dyes are not permanent; and the Jury have not been able to award the Prize for a permanent scarlet dye for cotton, offered by Lieut. Lance. The same is true of the Prize offered by Lieut.-Colonel S. Browne, for the best "khakí," or ash-gray dye.

Under the head of Dyes the report embraces the consideration of—(1), materials for dyeing, with incidental notice of *colors* observed in the fabrics exhibited in other classes; (2), calico printing, in colors and metallic leaf; (3), artists' colors, including coloring substances applied to turned wood ware, and colors employed in "míná kárí," or enamelled work.

The collection includes from No. 4437 to No. 4687. But, in this series, a very large number are merely the same substances exhibited from different districts. In some instances, such as indigo, the repetition is highly interesting and valuable as a means of comparison; in others, the difference is almost inappreciable. The list of *kinds* of articles exhibited is as follows:—

Indigo.—There are 14 specimens. One each from Delhi, Gurgaon, Hissar, Ambálah, Ludhiana, Jálandhar, Hushyarpúr, Kapúrthalla, Bahawalpúr, Pattiala, Muzaffargarh, Dera Ghází Khán, and Dera Ismaíl Khán and Jhínd.

There are exhibited from Lahore, though no indigenous indigo, a sample of ordinary dyer's Múltán indigo; another sample of indigo from Múltán, and a specimen of indigo from Messrs. Skinner's factory at Hansi, sent by them to the Central Museum some time ago.

Amritsar exhibits a sample of Múltán indigo, and also of a substance called "níl safá," which is not indigo, but Prussian blue (ferro-cyanide of iron), and probably obtained from Europe.

The factory of Messrs. Skinner and Co., exhibits a fine sample of indigo; as does also the Punjab Indigo Company, at Múltán.

From Sealkot there are two samples of indigo, one grown by Hakim Singh of Daska, another by Ganda Mal of Samryál.

Madders.—Samples exhibited by Jálandhar, Lahaul, Amritsar (not the produce of the district) and Lahore (the produce of Afghánistán), Dera Ismaíl Khán, Peshawur (imported from Kábul), Kashmír (imported from Múltán).

Safflower.—Nearly every district shows a sample in its pounded or unpounded state, viz., Delhi, Gurgaon, Rohtak, Ambálah, Ludhiana, Simla (Bhajji), Jálandhar, Hushyarpúr, Kangra, Amritsar (imported), Lahore (imported, 3 samples), Gujranwalla, Gujrát, Jhilam, Gugaira, Jhung, Muzaffargarh, Dera Ismaíl Khán, Dera Ghází Khán, Bunnoo, Peshawur, (from Kábul), Kapúrthalla, Jhínd, Nábha and Pattiala.

Harsinghár flowers (*Nyctanthes arbortristis*).—Exhibited by Delhi, Gurgaon, Ambálah, Gugaira and Pattiala.

Dhák flowers, "gulí-kesú" (*Butea frondosa*).—Exhibited by Rohtak, Ambálah, Jálandhar, Kangra, Gujrát, Jhilam, Shahpúr, Gugaira, Dera Ghází Khán, Kapúrthalla, Kashmír and Hushyarpúr.

Mehndí or henna (*Lawsonia inermis*).—Ambálah, Lahore, Gujranwalla and Shahpúr.

Sappan wood "bakam" (*Cæsalpinia sappan*).—Exhibited by Gurgaon, Jálandhar and Lahore.

Toon flowers (*Cedrela toona*).—Exhibited by Ambálah, Kangra, Kashmír and Pattiala.

Turmeric.—Simla (Bhajji, Baghat and Bagal), Jálandhar, Hushyarpúr, Kangra, Amritsar, Lahore, Dera Ismaíl Khán and Bunnoo.

A root called *ál* (*Morinda tinctoria*) is exhibited from Gurgaon (4450).

Lac dye from Delhi; *cochineal* from Peshawur and Lahore; a substance called *Berberine*, from Simla.

Ekl bír from Jálandhar, Kashmír and Kangra.

Kamela is exhibited by Ludhiana and Kangra.

Akasbel (*Cuscuta reflexa*) and *harmal* (*Perganum harmala*), are among the dyes of the Jhilam district.

Lahaul exhibits a kind of madder, or red dye, "kúáme;" and Spiti a wood, called "púrlú," and one called "nayálu."

Peshawur exhibits "flowers of asbarg" (*Delphinum sp*——?) from Kábul; as also Amritsar and Lahore.

Kashmír sends a dye called "darengri;" also "rál," a resin used in dyeing "pashm."

Kashmír and Dera Ismaíl Khán exhibit *saffron*.

Amritsar, besides the above-named substances, sends samples of substances called "akbíj," "boz gand" (the galls of *Pistacia*), and "harkadí."

Ludhiana sends a red dye, "kirm," a crimson extract, probably of *lakh*.

These form the principal coloring substances. There are also other substances of the nature of mordants, and substances used for intensifying the tints, such are the following:—

Tamarisk galls, "máíń" (galls of *Tamarix furas* or *T. indica*).—These are exhibited from Gurgaon, Jálandhar, Shahpúr, Gugaira, Jhang, Muzaffargarh, and Dera Ghází Khán.

Rind of pomegranate.—Exhibited from Gurgaon, Rohtak, Jálandhar, Kangra, Jhilam Shahpúr, Gugaira, Muzaffargarh and Dera Ghází Khán.

Dried mango parings.—Are sent from Rohtak, Jálandhar, Kangra.

Kishta, dried unripe apricot (*Armeniaca vulgaris*).—Exhibited from Jálandhar, Lahore and Amritsar.

Limes and *lime-juice*, also the *juice of the galgal* (*Citrus galgala*), appear in the collection of Rohtak and Kangra.

Jálandhar exhibits *bahera* (*Beleric myrobalan*), and *balelah sújah* (*Terminalia citrina*).

Kangra exhibits "dhoń leaves," "ańwlá leaves" (*T. emblica*), and "ańwlá rind."

Kashmír shows "máju," the fruit of the *Cupressus*. Substances used in the process of dyeing soap, soap-nuts and "ushna," are exhibited from Lahore, Jálandhar and Kashmír.

The iron mordants, "kahí safed" (proto-sulphate of iron, crude) "kahí sabz" and "kahí siyah," also containing iron, are exhibited from Lahore, Amritsar and Kashmír.

Alum and other substances, as well as one or two mineral dyes are noticed in the Mineral Department, and receive notice there.

There is a series of artists' colors exhibited from Lahore; also from Amritsar.

A series of colors prepared for the wood turner, from the same places;

And a few colored enamel sticks, for the "míná kárí," exhibited in Lahore.

Of samples of dyed fabrics, Lahore exhibits a frame of 72 dyed and printed samples; Amritsar, Kashmír and Lahore have series of dyed silk (unspun). Gujrát exhibits a series of hanks of cotton dyed, with samples of the dyed fabric attached; as does also Gugaira.

Muzaffargarh shows a series of samples illustrative of the process of printing in madder and black; and also a series of simple and compound dyes, produced from turmeric, indigo

and safflower; Múltán exhibits several beautiful printed fabrics; and Lahore, Delhi and Maler Kotla, &c., show specimens of fabrics printed with silver and gold leaf.

It remains now to add the remarks of the Jurors on the articles included under the heads just mentioned.

I. DYES.

Of these, the most valuable and important is indigo. It is peculiarly Indian in its origin, and began to be exported almost as soon as the Cape passage to Europe become known and followed.

It was known to the ancients as a product of the country. "*Indicum*," says PLINY, "comes from India, and is obtained from a slime adhering to reeds: it is black when rubbed, but a fine mixture of purple and blue when dissolved." He adds, "that the genuine *Indicum* may be known by the purple vapour it emits on being heated," and that it "emits a smell like the sea, whence some have supposed it to be obtained from rocks."

The history of the commerce of this substance would be eminently interesting, but it is not possible to enter on the subject within the bounds of a report; suffice it to say, that on its first introduction into Europe, it was almost driven out by the bitter intolerance of persons whose object was to prevent the old fashioned *woad* (then in use as much as indigo is now) from being driven out before it. In 1557, at Frankfort, it was denounced by the Germanic diet as the "Devil's dye," and its use forbidden: the prohibition was repeated in 1603; and as late as 1654, by Imperial Edict at Ratisbon, the proscription was enforced. In England an act was made in Elizabeth's time, authorizing the seizure and destruction of the offensive substance, as well as the detention of persons possessing it. The act continued in force till the reign of Charles II.: and "Brazil wood" shared the odium with it.

Notwithstanding all this opposition, the dye has become an article of universal importance, its peculiar chemical properties rendering it suitable. It can be applied as a dye in cold vats, and is one of the most permanent dyes known, and that without the use of any mordant or fixer.

Indigo is known to chemists under two forms—white indigo (indigogene) and blue indigo—the latter being only an oxidized state of the former. The blue color is entirely due to the oxygen, or at least comes to the substance as it gets access to the oxygen of the air; this is observable in the vats. When the fermented liquor or infusion of the plant first ferments with the appearance of whitish gray bubbles, afterwards these become blue, and finally a deep metallic lustred purple-red. Dyed cotton, when just taken out of the dyeing vat, appears green, but rapidly assumes its deep blue tone from contact with the air.

Blue indigo is perfectly insoluble in water, but it is found that it is so only as long as it retains its excess atom of oxygen. If it can be induced to part with that, the remaining indigogene is soluble in an excess of sulphate of lime, or other alkali. Hence, for cotton dyeing, the vat is prepared by grinding up a quantity of indigo with water to the consistency of cream, and then mixing it with copperas, and an excess of lime or alkaline water; the oxygen of the indigo then combines with the protoxide of iron in copperas to form oxide, and then the deoxidized indigo readily combines with the lime water, forming a yellowish green liquid, into which the fabric to be dyed is plunged; and then, on being taken out and exposed to the air, the oxygen returns to the solution with which the fabric has been saturated, and the deep blue is restored and becomes permanent, without the use of any mordants. The dye applied in this manner is used cold. According to the plan adopted by native dyers, "chunám," "sajji" (crude potash) and "gurh" (molasses), form the solvent and

deoxidizing agents; otherwise, the process is identical; they do not use copperas, though they have it in plenty, in the form of "híra kasís" or "kahi safed." Wool and silk are not dyed in this way, but in another manner, taking advantage of another property of indigo. Pure indigo is soluble in sulphuric acid, but the solution is thick and black. This has been called *cæruleo-sulphuric acid, sulphindylic acid*, &c. ("murabba" in Urdú), because it has the nature of both the indigo and the acid, neither undergoing the slightest change in itself. A sample of this sulphindylic acid is exhibited from Lahore, by a manufacturer, Bashi (892), and from Jálandhar (4186), where it is incorrectly called "sulphate of indigo solution." The substance is not a sulphate of indigo, that would imply a chemical combination between the acid and the dye, and the formation of a new substance; but it is not so. The acid and indigo combine, but neither is changed. This solution is capable however of destruction by an excess of caustic alkali, and turns by it to a yellow color, from which nothing will restore it.

This sulphindylic acid is principally employed in dyeing wool and silk, and the excess acid is removed by washing in alkali.

Chemically pure indigo is of specific gravity 1·50, and possesses neither taste nor smell; it is a substance "indifferent," having neither acid nor basic properties. Good indigo is known by its fine purple blue color, and by its fracture, which, when rubbed with a hard smooth substance, exhibits a coppery red lustre.

No remarks need here be added on the manufacture of indigo: the ordinary processes of fermentation of drawing off the liquor, of beating, and of collecting the "fecula," or precipitate of indigo from the liquor and pressing it, are universally well-known, and are followed with but trifling variations in different provinces and different manufactories.

The main points appear to be, the watching the soaking plants, so as to be able to tap off the infused liquor exactly at the right point of fermentation; and next, to beat the liquor in the second vat, exactly long enough. No doubt in these points the native manufacturers in this province are as yet eminently deficient. Knowledge of these things can only be acquired by careful observation and long experience. Another point is, that the "fecula" is much improved after being collected, by being boiled in coppers, and then pressed into its boxes.

Indigo manufactured by simply collecting the fecula, and dropping it down in cakes to harden in the sun, is termed "*gaud indigo;*" to this class of indigo belong all the specimens exhibited, with the exception of the sample sent by Messrs. Skinner and that of their make exhibited by the Lahore Museum; and also that of the Punjab Indigo Company, at Múltán.

There can be no doubt that the samples of indigo from the Hansi factory of Messrs. Skinner & Co., are the best—their indigo is better got up than any other; while its close grain and beautiful color, places it beyond other competitors in the Exhibition. Hansi, politically, is within the Punjab and provinces for which the Exhibition is intended. The Jury, therefore, award to Messrs. Skinner & Co., the Prize for the best indigo in the Punjab, commuting the money prize to a Silver Medal and Certificate of Merit.

Next comes the Punjab Indigo Company. The indigo of this Company deserves high commendation—that it is not equal to Messrs. Skinner's is saying no more than would be expected, from the time the Company has been in existence, and the great difficulties it has to contend with. The indigo exhibited is fairly got up, and of good color; there can be no doubt that succeeding years will see the growth of this Company, both in quantity and quality of its products. The Jury have awarded to the Company a Silver Medal.

Next to these samples come the samples of the Punjab districts. They are all of them "gaud" indigo; and some of that hard black, or pale blue tone of color, which indicates extreme badness of preparation. But amongst the samples, there are some indicating a decided advancement in the production of the dye. The color in one or two of these samples is good, and only shows what might be done if the growers of indigo in these districts would be bold enough to make an outlay for the necessary machinery of good vats, boilers, and presses. It would not require much philosophy in them to perceive that the present outlay of some hundreds of rupees would be amply repaid, if the same indigo, which they now sell at from rupees 50 to 80 per maund, could be made, by efficient preparation and "getting up," to sell at from rupees 150 to 250 per maund! It is not intended to be supposed, that building good vats and setting up coppers and screw-presses is synonymous with the out-turn of indigo like that of Messrs. Skinner; but there can be little doubt that indigo like that of Dera Ismaíl Khán and the Sealkot samples, would, if better prepared, *at once* command a *higher* price; and eventually, if the growers only persevered in care and observation, would attain the full value above alluded to.

Anxious, therefore, to encourage a move in the right direction, quite as much as to reward positive attained excellence, the Jury award a Certificate of Merit to Dera Ismaíl Khán, for "gaud" indigo of good color; and also mention with approbation the indigo grown by Ganda Mal of Samryál, and by Hakim Sing of Daska, in the Sealkot district. Especial improvement might be made in collecting, drying and pressing the fecula in these samples.

At present Múltán is the place where the greater quantity of indigo used by the native dyers is brought;* but indigo is extensively grown in the Dera Ghází Khán district. It is hardly grown at all as a standard crop in other districts. This is much to be regretted, as the soil and climate of many districts appears well suited to the cultivation; and with the experiences of Bengal ready to hand, we have nothing to fear on the score of those cultivation difficulties, which in other places threatened to bring the crop into disrepute.

Besides, the samples of indigo just described, there are several samples of "kulaf," or "vasma" (pounded dried leaves of indigo plant), used principally as a hair dye, after the previous application of "henna" (*Lawsonia inermis*). The powdered leaf of *Indigofera anil* is used in the cure of hepatitis.

Indigo is said to be produced from several species of *Tephrosia*, *Nerium* and *Wrightea*, and even from the *Cicer arietinum*, or gram plant. From some of these species indigo is manufactured in China, as described by Mr. Fortune. The species ordinarily cultivated is the *Indigofera indica*, of which there are some varieties, known as *I. tinctoria*, *I. pseudo-tinctoria*, *I. glauca*, *I. disperma*, &c.

Indigo sublimes at a temperature of about 400° (Fahr.), leaving behind it the residue of carbonaceous and earthy matter. Several samples of the Exhibition indigos have been taken 10 grains of each, and the indigo sublimed; when the residue was weighed the results were as follows :—

* The Settlement Report in 1859 says, that 48,000 beegahs were cultivated with indigo. It is now probably much increased. About 40,000 maunds of indigo are yearly produced, and not a little of this finds its way over the frontier to Kábul, &c., in exchange for madder and other commodities. The establishment of the Múltán Indigo Company will no doubt tend largely to increase the production of indigo, as well as to extend the trade Native dyers prefer always the Multání indigo, but also like much an indigo brought up from the Delhi direction, from Khúrjáh, a place to the south of Bulundshahr: they call all indigo prepared under European factors, and on the European methods, "Wilayiti nil," a name which is sometimes incorrectly given to the Prussian blue, which is imported in lumps, and is not unlike the fine pieces of indigo.

Of 10 grains,	MESSRS. SKINNER (Hansi), residue weighs,	6 grains,	very nearly.
	PUNJAB INDIGO COMPANY,	$6\frac{1}{2}$ "	"
	Dera Ismaíl Khán (gaud),	$6\frac{1}{2}$ "	
	Sealkot (Samryál),	$6\frac{3}{4}$ "	
	Dera Ghází Khán,	6 "	
	Múltán district,	$6\frac{1}{2}$ "	
	Muzaffargarh, ...	$7\frac{1}{4}$ "	very nearly.
	Ambálah,	$6\frac{1}{2}$ "	
	Gurgaon,	7 "	
	Hushyarpúr,	$6\frac{3}{4}$ "	
	Jhind,	$6\frac{1}{2}$ "	
	Bahawalpúr,	8 "	

The residue of MESSRS. SKINNER'S, and other good indigo, is of a porous spongy carbonaceous substance, large in bulk but light in weight, containing but little earthy residue; that of the inferior samples, is in powder and heavy, indicating earthy matter and solid impurities; the inferior indigos, particularly the pale colored ones, such as Bahawalpúr, sublime along with the pure indigo a strong smelling smoke of reduced vegetable matters. The difference in purity is highly appreciable; if, for instance, calculation be made, on these data, it appears that the Dera Ismaíl Khán "gaud" indigo, contains for every 10 grains, $\frac{1}{2}$ a grain more earthy and other matters, than the Hansi indigo; thus in every maund has something like 4 lbs. more impurities.

The Gurgaon, Hushyarpúr and Ambálah samples, are blackish, hard, coarse, and evince great inferiority of manufacture. The Bahawalpúr sample has a pale bluish color, and appears to be defective in the primary fermenting and beating processes, or to be a bad style of plant. The other samples might be really good indigo if prepared, dried, and got up better. Indigo has been of late years cultivated in Jammú, and the best is grown at Katúa, near Madhopúr; it sells at Rs. 105 per maund. A sample sent to the Exhibition was not so good.

Indigo is of some use in medicine, being said to be effectual in cleansing foul ulcers. The juice of the young shoots is mixed with honey for children suffering from aphthæ in the mouth.

The next dye on the list, and second only in importance to indigo, is madder (*Rubia cordifolia* or *Rubia munjista*). It is exhibited from two or three districts, but only because it is in use there; such is the case with the samples from Lahore, Amritsar and Jálandhar, which are all probably the produce of Kábul or Afghánistán. A sample from Peshawur is marked as coming from Kábul; while the Kashmír specimen is marked as not produced in Kashmír, but is brought in quantities from Múltán. One very interesting sample is exhibited by the REV. MR. JAESCHKE, from Lahaul, it is of the species *R. cordifolia*, and is grown at Lahaul; though perhaps not equal to the Kábul madder, it is of good quality and color. Madder appears to be abundant in the valleys all along the Himálayan range—it is found at Dharmsala; and DR. CLEGHORN writes, that he gathered it in the Chandrabhaga valley. The root is procurable in the bazars of Simla and Chamba, but there is little demand. Among the woven fabrics exhibited by the hill districts, there is but little evidence of any dyeing process at all, but here and there instances of madder dyed articles appear. The borders of some of the Simla and Kangra district blankets are woven in with madder dyed threads. The principal place of production appears to be in the Afghán territory, in the Province of Kábul, and the districts of Ghazní and Kandahár.

MR. DAVIES, in his Report on the Trade of the Frontier, mentions two kinds of mad-

der—one called "rodung kuhree," grown at Kandahár, which is superior; and the other kind, "rodung phurreah." The plant is stated to require three years to come to maturity. The value of madder brought through the Biluch and Afghán mountains, is stated to be £12,228. It is to some extent remarkable that the Kashmír sample should not have been produced *in situ*, for there is every reason to suppose that madder might be cultivated in Kashmír with great success.

Múltán is a great emporium for madder. The Kábul merchants come thither direct from Dera Ismaíl Khán, *viâ* Leia, and exchange their madder for cotton and indigo. A sample of madder is exhibited from Dera Ismaíl Khán also; but it does not appear whether it was produced there or whether it was only brought from Kábul, as above mentioned.

The subject of the growth of madder in the Punjab has been brought before the Agri-Horticultural Society, and a quantity of French seed was actually raised by Mr. Cope, and samples of the root forwarded to England.

The native dyers judge of the excellency of madder by breaking a root across. The finest specimens are of middle size, neither very thick nor yet wiry; they break short off, exhibiting a surface of a beautiful fresh creamy yellow; the inferior specimens having a dingy reddish tinge.

In Europe madder is grown in several Provinces of France, but the best is the Dutch from Zealand. It flourishes best in a light soft soil, but will also grow in a stiff clayey one. A fine variety is imported from the Levant. The red coloring matter of the root is soluble in alcohol, and yields various tinted precipitates, with the fixed alkalis, sulphuric acid and sulphate of potash; and various shades are obtained by precipitation with alum, nitre, chalk, sugar of lead, and chloride of tin.

The process of dyeing with madder as practised by native dyers is simple: the dye color is deepened afterwards when required by alum. The fabrics to be dyed are first steeped in a decoction of "máín," the galls of the tamarisk, and then submitted to the madder solution, hot. It is fixed by alum as a mordant, the galls seem to impart to the cloth a facility for taking the color. The color thus obtained is a deep full red, it is quite permanent, but is not brilliant, cannot by any stretch be called scarlet; hence the Jury have not thought right to award to specimens of this dye, the prize offered for a scarlet dye; nor have they awarded any for the root, as none, with the exception of the Lahaul sample, is indigenous. It is most remarkable, however, that the beautiful and permanent dye, known as "Turkey red," and which does deserve the name of scarlet, is a dye of Indian origin. The process was learnt in India and carried to Eastern Europe, whence it found its way into Greece, and was introduced into France and England in the middle or end of last century. The process consists in preparing the fabrics to be dyed, by previously saturating and working them up with a mucilage, composed of olive oil, with a proportion of alkaline lye, not sufficient to saponize the liquid, and with cow-dung or sheeps'-dung. These substances, are intimately combined, and the fabric is made to imbibe into its pores this substance. This process evidently reduces the fibre of the piece to a peculiar condition, fitting it to receive the dye of madder. The cotton, after having been treated with the oily mixture, is steeped first in gall solution, and then in an alum solution, after which it is boiled in madder, with which a portion of animal blood is mixed, and the process is finished by washing the dyed cotton in a boiling solution of white soap. Notwithstanding, as before remarked, the fact that this process originated in India, it does not now appear to be either remembered, or practised, at all events, in Hindústán and Upper India. It is probable that the "chaya" root (*Oldenlandia umbellata*), a sample of which has been forwarded from Madras for comparison,

was the root employed in dyeing according to the process just described. The whole of the red cloth, so common in every part of India, and called "sálú," is imported from Glasgow and Mancester, where the process is carried on, and the imports of this kind of cotton fabric must be very extensive. It is much to be regretted, that having the dye-stuff on the spot, such a profitable art should have been lost; and it yet remains for individual intelligence and enterprise to re-establish it, the attempt to do so could hardly fail to be successful and profitable, as it does not appear that any complicated machinery is at all essential. The process, it may be mentioned, was started in Glasgow in 1790, and the Commissioners of Trade purchased the secret, which was only to be divulged after a given period, now long elapsed. Madder dyeing in Europe is practised with much happier results as to color, which is probably owing in part to the superiority of the Dutch madder (*Rubia tinctoria*), but mainly, no doubt, to the very superior process of dyeing employed. This dye is capable of combination with indigo, and other substances, to form compound tints of various shades and degrees. In Europe a very beautiful permanent series of artists' colors, varying from the palest pink to carmine is produced from Dutch madder. No attempts seems to have yet been made how to produce such colors from Indian madder.

Closely allied, in a dyer's point of view, to madder, is the sample, which is the only one sent, of the "ál" root (*Morinda tinctoria*), (4450), from the Gurgaon district. This is stated to grow everywhere in India, but is certainly little, if at all, known to Punjab dyers. It is a small whitish root, yielding a red color. It appears nearly all species of *Morinda* yield red dyes.

The next dye that claimed notice was the beautiful *kussumba (Carthamus tinctorius)*. or safflower, called also bastard saffron.

The value of this substance as a dye is much lessened by the fact that it has no affinity for any mordant, and therefore cannot be made permament; the series of dyes it gives are most beautiful, consisting of lake reds of all shades, from the deep "gul-i-shaftálú" to "gulábi" and "piyázi" pinks of the palest tone; combined with turmeric it yields a beautiful scarlet; and with various blues—indigo, Prussian, and ultramarine—gives lilac and purple tints of great beauty; none, however, being permanent. The fabric to be dyed with safflower is first steeped in the acid solution of "kishta." The flower yields two colors—first a yellow and then the red—the flower is reduced to a powder, and then treated with water till the yellow color ceases to appear, the residue is then pressed into cakes, and yields the red dye. In Europe a fine red powder is precipitated from the infusion of the red dye, and collected as a rouge. The number of samples of the dye, both pounded and unpounded, is very great; it appears to grow freely in almost any district thoughout the province, though it is scarcely a generally grown crop in any of them, except perhaps in Hushyarpúr and in the hill districts. A sample in the Lahore Museum was produced in the Gurdaspúr district. Native dyers reckon the hill safflower the best; and good samples may be known by the clear brilliant color of the flowers. A second quality is known as Hushyarpúrí, which is not quite so good. "Gujrátí kussumba" is also a kind mentioned by the Lahore dyers—examples of each of these kinds appear in the Lahore collection. Of samples exhibited, the best is that from the Kangra valley (4496), and the Jury award to it a Prize of two Shares.

The other hill safflowers, from the Simla States, were good. Of plain districts, the Gugaira sample deserves mention (4619). It was valued at about $1\frac{1}{2}$ seers to the rupee; the Hushyarpúr and Jálandhar samples at about $2\frac{1}{2}$ seers; and the Ambálah at 3 seers.

Of cloths dyed with kussumba, a fine series was exhibited from Lahore, showing all the

shades. An interesting series appears also in the Muzaffargarh collection, and there are samples from Gugaira. There is a successful sample of thread dyed scarlet with turmeric and "kussumba" in the Gujrát jail: it is only a pity that so beautiful a tint should not be permanent.

The only other red dye in the collection, indigenous to the Punjab, is the *lac* dye—a small quantity of which was exhibited from Delhi. The growth of the gum lac, is noticed under the Class of Gums and Resins, and therefore needs no further mention here. The crude lac is gathered and the color is extracted by solution, it is then concentrated and clarified: it yields a fine color, much used to dye silk.

A sample of cochineal is exhibited from Peshawur; it had been obtained from Bukhárá, to which place it was imported from Bombay. It yields the most beautiful series of pink and crimson tones for silk dyes, and is capable of combination with pale blues, till it gives tones of a beauty almost equal to the magenta and rosanaline dyes of Europe. It is no doubt a regular article of import trade for Bukhárá, and the Bukhárá silks (a series of which are exhibited in the Lahore collection) as are dyed with it. It is imported also to Kashmír, and may be found in most places where silk dyeing and weaving is carried on.

Among the pashmina fabrics of Kashmír, there was one plain shawl, of the most beautiful magenta shade, with a slight tinge of blue; this might have been dyed with an European rosanaline, but it was more probably a native cochineal dye; and if so, vies wonderfully with a fine sample of a dyed silk piece exhibited from Amritsar, by CHAMBA MAL (Series No. 9620-23), which was actually dyed with rosanaline.

One or two samples of *sappan* wood occur, which yields good, but not permanent, tints. The wood is called "bakam," or "vagam," or "pataug" (*Cæsalpinia sappan*). It is not produced in the Punjab at all, and is imported partly from Southern India and partly from Bombay. It is a congener with the Brazil, Brazilletto and Nicaragua woods of the dyers.

Among the articles sent up from Madras, a concrete red dye, from a species of prickly pear, and a bottle of red ink of a beautiful color, demand notice, as they call to mind the fact, that a species was once very common in the Jálandhar and Hushyarpúr districts; in fact it became quite a nuisance: it was destroyed, however, by myriads of the wild species of coccus, which yields an inferior cochineal.

A reddish color is yielded by the "henna" or "mehndí" (*Lawsonia inermis*), exhibited from several districts: it is used by women to stain the tips of their fingers; and also as a hair dye. The hair is first dyed with henna, and then with indigo, to made a black, otherwise the substance is of little importance. The natives esteem most the Gujranwalla "mendhi."

There is a substance used for dyeing red in Lahaul, and called "kúámí." It is a long dark-colored root, of a species allied to the *Anchusa*, and called *Onosma echioides.* There is no sample to show the color produced.

Of yellow dyes a considerable number appear.

The flower of the *Nyctanthes arbortristis*, exhibited from several districts, yields a yellow dye of a good color.

And the *dhák flowers*, "gul-í-kesu," also are exhibited from a number of districts. They are themselves of a yellow color, and yield a yellow dye; similarly, the flowers of the tún (*Cedrela toona*).

Ekal bír, the roots of the *Datisca cannabina*, is valued as a dye. Yields a pale yellow dye, which also enters into the composition of an apple green dye. It is used principally

in dyeing wool and silks: and it is exported from Lahaul, Kúlú and Pangí. The sample exhibited was from Kangra.

Turmeric, "haldí" (*Curcuma longa*), is a root of considerable importance, both as a food, a condiment, and a dye. The native dyers readily distinguish the kinds best suited for dyeing from those that have the best edible qualifications. The turmeric from Hushyarpúr is about the best (4084), and receives a Prize of One Share. The Jálandhar sample is better as an edible sample than as a dye. Some very excellent turmeric has come from several of the Simla districts; and some samples of the root, fresh and undried. The root is medicinally considered cordial and stomachic; as a dye it is a beautiful, but not very permanent, color. The best used of eating turmeric is caled *ágrái:* the best dyeing sort *chawán.*

Asbarg is a dye not permanent, and used principally in dyeing silk: it appears to be a species of blue-flowered *Delphinum*: the Peshawur specimen is from Kábul. It is not grown in the plains.

Kamela, is a somewhat remarkable substance, being the reddish powder collected off the capsules of *Rottleria tinctoria.* In medicine it is purgative.

Last, among the yellow dyes, but not least in value, is saffron, like turmeric used as a condiment and article of food, as well as a dye. A fine sample of saffron from Kashmír, was exhibited by Pundit Munphool. Dera Ismail Khán exhibited a sample, though it does not appear whether the sample is the product of the district or imported from the hill districts of Afghánistán. Saffron is not cultivated in the Punjab plains at all, but is so extensively in Kashmír. The substance consists of the dried stigmas of *Crocus sativus*, and its coloring matter is very peculiar, and has been termed *Polychroite.* It is totally destroyed by the action of solar rays; and forms blue and green tints with nitric and sulphuric acid, or copperas. It is not much used as a dye. Its original habitat is not known, but in Sanscrit it was called, "kasmírajamna," suggesting Kashmír.

A few other individual samples remain to be noticed. Amritsar shows some of the little hollow galls of *Pistacia terebinthus*, called "boz gand," and a substance called "harkaddi," which did not come to the notice of the Jury. Unfortunately, the same occurred with the Kashmír sample of "direngri," which was not to be found, and therefore nothing can be said of it.

The "purlu" and "náyálu," from Spiti, are twigs of some trees abounding in tannin principle.

The "harmal" seeds (*Peganum harmala*) from Jhilam deserve notice, as the substance is beginning to attract notice in Europe. A principle called harmaline has been extracted from the seeds, used in black and brown dyeing; the plant and seeds are also used by natives as a drug and fumigatory to eject evil spirits.

The plant is found abundantly on waste and broken ground in most parts of the Punjab—though a plant limited as to the region in which it grows—large quantities of the seed might be collected, if it were found of sufficient value to export.

The above includes the whole of what is note-worthy in the dyeing substances. It remains to notice these substances which are used as *mordants*, or else as substances, which not having color in themselves, help in the formation of black and other dyes. Such are the galls of *Tamarix furas*, the "dháo" leaves of Kashmír, and the "kíkar pods (*Vachellia farnesiana*): other substances appear to *brighten* the colors, as "*kishta*," &c., and they are also included.

Alum is much used as a mordant; and "kahi siyah" and "safed," earths containing iron

in one form or another; but the use of the salts of tin, which seem of great efficacy with delicate tints, appears unknown.

Máin (or the galls of the *Tamarix furas*) are much used in dyeing. All the madder dyed cloths are first steeped in it. It is also used in dyeing black with salts of iron. There are two kinds—"máín barí" and "máín chotí—but there does not appear to be any difference really, save that the large galls picked out form the "máín barí." They are both the produce of the same tree. The number of specimens exhibited is considerable, as might be expected, from the facility with which the tamarisk grows in almost every district. It is particularly abundant in Jhang district.

The *rind of the pomegranate*, "naspál," yields a yellow color, and is highly astringent: it is much used in dyeing yellow with other substances. This is likewise produced from various districts; and although the fruit borne by pomegranate trees generally in the province are almost unfit to be eaten, the rind does well for the purpose of an astringent dye.

Dried mango slices, "ám chúr," yield an acid solution like "kishta," employed along with some dyes to brighten and fix the color.

Lemons.—Lemon juice, and the juice of the "galgal." Exhibited from Rohtak and Kangra, are useful in the process of dyeing black.

The remaining substances "májú" (fruit of *Cupressus*), "balola sujah" (*Terminalia citrina*), "bahera" (*T. belerica*), are highly astringent, and are used in dyeing black. "Bahera," particularly, in making black leather.

Similarly the "dháoṅ" leaves, *Conocarpus latifolius* of Kashmír, also the "aṅwla" leaves and rind (*Phyllanthus emblica*), abound in tannin or other astringent principles, and might almost be classed under tanning substances. The "dháoṅ leaves" yield a "khákí" dye to cloth, previously prepared with iron: the pods of the "bábul" (*Vachellia farnesiana*) are similarly employed; and a specimen of cloth thus dyed was found in the Delhi book of dye samples.

The use of mordants does not appear to be well understood by natives. The principle of their employment is, that if mere color, soluble in itself, be imparted to a fabric, it will again wash off; but a mordant is a substance which can fix the color in an insoluble form in the fibres of the stuff. The mordant need not have any attraction for the stuff, but simply while in contact with the stuff, renders the color of the dye insoluble within the fibres. Indigo and safflower have no affinity for any mordant; but indigo fixes itself without, because it is insoluble already, and is rendered soluble during the process of dyeing, the dyed cloth being exposed to the oxygen of the air. The soluble indigo it had imbibed becomes insoluble.

Much benefit would accrue to the art of dyeing in this country, by the introduction of the tin mordants, acetates of iron and lead, &c. Native dyers miss many a good color by the want of these: for instance, bichromate of potash, "kahi surkh," is to be found in any bazar, and yields a fine series of yellow and orange tones, with salts of lead as the mordant.

Of dyed cloths, besides colors which are to be noted, even though the fabric was exhibited in the manufactured department, there are a series of about 72 dyed cloths, prepared by a Lahore dyer, exhibiting a creditable series arranged in tints, and showing what a multitude of shades are producible from the comparatively few and simple materials that are employed.

A series from Muzaffargarh, Gugaira and Delhi also appear; and Gujrát sends a good series of dyed threads. Silk dyeing is illustrated with success from Lahore, Amritsar and Kash-

mir. Some tints are very beautiful, and in the case of silks, for the most part permanent. The Jury have awarded to Lahore a prize of two Shares for the series of dyed cloths.

II.

There are also to be noticed some interesting specimens of printed and stamped cloths, both in colors, and in gold and silver leaf. These are included, either the Cotton or Embroidered Departments, and are there unnoticed, as it is the printing art and not the fabric that is remarkable. There are colored cloths exhibited from Lahore, tahsil Kasúr, and from the Thuggee School of Industry: from Gugaira (6099, 6104-05, and 6114); from Múltán (6036-67-68-69); Kapúrthalla (6186); Gujranwalla (7574); Ludhiana (5784-85); the printing in silver and gold is illustrated from Delhi; from Kangra (7496); from Lahore, (of a superior quality), (8711-12); and besides this, from Peshawur. There are several articles of clothing also more or less printed in this way. A very interesting series from Muzaffargarh shows a pattern in all its stages, together with the wooden blocks used in printing. These blocks are cut from a hard dark wood, with considerable ingenuity.

The Muzaffargarh sample (1047) is of black, and two shades of red. The cloth is first steeped in galls, and then a block prepared with iron salts, struck on this produces a line or black figure. Next, the parts that are intended to be a deep red are treated with alum, made into a paste with ochre, and the whole is boiled in madder: the iron black remains, and wherever the alum has been, the madder, fixes in a deep shade, and in other places in a lighter shade. Many of the samples are, however, produced solely by the aid of blocks without boiling the whole in any dye: such are the Múltán and Kasúr specimens. The compound colors are produced by printing one block over another, blue over turmeric for green, &c., &c.

The Jury has awarded to Múltán printed cloths a Prize of two Shares, for their printed cloths (6036-37-38-39)—for their pattern, excellent coloring, and the neatness with which the prints of the blocks has been effected; and a two Share Prize is also awarded to Muzaffargarh, for the illustrative series, alluded to above. It should be remarked that these printed fabrics are not fast colored, and the European art of making *fast* cotton and muslin prints has yet to be introduced: the improvement too, in pattern, will come with improved design, knowledge and taste.

In the case of the gold and silver printing, the parts intended to receive the metallic leaf, are stamped as by a block with a thick "lera" gum (a coarse arabic or sirris gum); and then gold or silver leaf or imitation gold and silver leaf laid on, as the case may be: these kinds of fabrics are worn much in the hills on gala days.

One sample of printed cloth was very remarkable, it was an Afrídí woman's dress, from Peshawur; here pieces of the shape of leaves had actually been raised up on the fabric. This is effected by means of a composition into which gum-lac enters largely. The composition, while soft, is stamped thickly on to the fabric, in shape of leaves, &c., and left to dry, when it stands out in relief. It is finished by hand with a coating of colored paint.

III.

The last department included under "Dyes," are artists' colors, exhibited from Lahore and Amritsar. Wood turners' colors, and enamels, or colors used in the "míná kárí."

The artists' colors are some of them indigenous, some imported. They are sold in lumps, just as at home, and prepared by being ground up with a little water and gum, and spread over the shell of the river mussel.

There is no native preparation at all analogous to European cake colors, far less the moist or oil colors. Of the latter indeed, an inferior bad smelling oil color is produced, but not for artistic purposes. This is a great pity, since the manufacture of oil colors, both for artists' and for house-painting, is by no means difficult. Oils abound in the province, and might be rendered drying by boiling or the addition of carbonate of lead. The sundras or copal, yields an excellent varnish when boiled with oil; and turpentine is easily procurable. The method of preparation of water colors is what gives the heavy body color like look to all native paintings (unless they have been executed, which they often are, with European cake colors). They are unable to grind the colors with sufficient fineness to produce transparent washes of color.

These tints are several of them indigenous—such as the verditer (sub-acetate of copper), "zangár," dragon's blood (juice of *Pterocarpus draco*), ochre, light red, "gerú" and "peori" (Indian yellow), a curious substance, gathered as a sediment from the urine of cattle fed on mango leaves, and some other plants.

Several are imported and European, such as *peori Wilayati* (chromate of lead), the (emerald green of painters), and "lájward," or imitation ultramarine, a substance now very common, produced artificially, in imitation of real ultramarine (lapis lazuli) ; it sells for about Rs. 4 a seer. The real ultramarine, is procurable in small quantities. "Hartal," or orpiment, is commonly in use, and is said to come from Southern India.

The native color series is very defective in browns. Their indigenous brown tints are prepared at a great expense in shells (these tints are called "dar chíní," &c.), the European Cologne earth, Vandyke earth, sepia and sienna earths are quite unknown, save as imported colors. It is remarkable, however, that bone brown (the finely sifted powder of partially charred bones) is not in use, for it is easy of manufacture, and cheap : the color is a tolerable one, though not much used in Europe an account of the superiority of the earth browns, before alluded to.

Colors for the wood turner are prepared by mixing the powdered color with lac and sulphur into sticks. They are applied by pressing the color stick against the turned article while it revolves rapidly; the heat evolved by the friction being sufficient to melt the lac, and the color spreads on the wooden article, and is afterwards smoothed by the edge of a piece of bamboo used as a burnisher.

As to the enamel colors they consist of vitreous matter, colored by cobalt, and other metallic oxides capable of diffusing their coloring matter through the substance. Blue and green form almost the only tints used. This kind of enamelling is applied to silver vessels, on which a flower pattern is first cut out in relief, and the ground is then filled in with enamel : the effect is very pretty, and is well illustrated in the collection, under "Precious Metals," from Kashmír.

In thus drawing to a close the Report which, from the importance of the subject matter, as well as the number of specimens included, has necessarily been rather lengthy,—it cannot fail to strike the observer that the art of dyeing—one of the most valuable of the ornamental arts of civilized life, is almost at a stand still. The knowledge of the art possessed by natives is wholly empirical, the recipes are handed down by one generation to another, and it is probable that 50 years ago, precisely the same dyeing was done as is now—and yet the aptitude of the dyers for their art, and the really wonderful manner in which they

produce tints of considerable beauty, with the few materials and earthen pans which form their whole stock in trade, certainly render them deserving of a better fate. It remains for European intelligence to improve the art by aid of chemical knowledge, especially in the way of showing methods of fixing the colors, and in the improvement of mordants. One of the most hopeful arts appears to be that of cotton printing. If only the printed colors could be fixed so as to stand washing, and a very small amount of taste introduced, to make neat patterns and suitable coloring, a most useful series of cotton prints and chintzes might be produced with great success. The import of these fabrics must be very large. There seems no reason why they should not be prepared here: at present printing is only done by natives on inferior cloth, but it might be done with ease on good material, when once a fixing process became practised, which rendered washing the fabric practicable. No art suggests so much the want of Vernacular Instructors or Trade Manuals as that of dyeing. A simple book on the processes of dyeing, as they are and as they might be, would be a great desideratum: the same may be said of oil paints. There is abundance of material for the production of good house paint (to say nothing of artists' oil color), and yet at present we are condemned to bare wood-work or sticky varnish. It is only to be hoped that these suggestions may be taken up by some person, possessed of intelligence and enterprize enough to try and introduce the simple, but much needed, improvements alluded to.

BADEN POWELL,

Reporter to the Jury.

CLASS IV. SUB-CLASS (D). TANNING SUBSTANCES.

The preparation of leather is carried on more or less in every district, but the best is done at Shahpúr and in Gugaira; while the red goat skins of Nurpúr (Kangra district) are famous, and are a staple article of trade.

1717.—Bark of the bábúl or kíkar *(A. arabica* and *A. vera).*

This is the commonest tanning substance, because the tree producing it is common all over the province. The bark is highly astringent; and, besides its use as a tan, it is used medicinally. The pods of the "kikar" are collected and sheep are fed on them; while from the seed vessel of *A. vera*, a bitter gummy extract, called "akákiá," is obtained. The bark is used in the distillation of spirits.

Specimens of the bark were sent from—

(4638) Delhi.
(4639) Rohtak.
(4653) Dera Ghází Khán.
(4695) Shahpúr.
(4700) Gugaira.
(4072) Muzaffargarh.
(4706) Pattiala.

1718.—[4416]. Acorn cusps, containing tannin and gallic acid; and

1719.—[4418]. Extract from the same. Hills near Simla. Mr. Geo. Jephson.

1720.—[4690]. Oak bark, of two varieties *(Quercus incana).* Simla. Mr. Geo. Jephson.

A sample of oak bark (rín) is sent from Hazárá (4705).

1721.—[4691]. Máju phal. Kangra. Local Committee.

These are called gall nuts, and might easily be mistaken for such, but are in reality the round, or rather polygonal fruit or berries of the cypress, and other allied species. Máju, however, is very often a real oak gall; this must be imported, as I am told that the hill species of oaks never have galls, and these are the only indigenous species.

1722.—[4694]. Mulla bark *(Zyzyphus nummularia).* Jhilam.

1723.—[4696]. Post jhánd, bark of the jungle bush *(Prosopis spicigera).* Shahpúr. Local Committee.

A sample is also sent from Gugaira (4699).

The following account of the tanning process has been received from the Local Committee at Shahpúr.

A cow hide is the most generally useful, being strong and soft. The harness sent to the Exhibition was all made of it: a good one is worth Rs. 2.

A buffalo hide is the strongest of all, but very hard. It is used for shoe-soles, &c.: worth about Rs. 4.

A camel's hide is too hard for most purposes, but is used for making "ghi dubbers:" value Rs. 1.

A bullock hide is inferior in usefulness to a cow hide.

A horse hide is scarcely any use at all, being too thin and fine.

A goat's hide is useful for parts of womens' shoes, &c.: value about 2½ annas.

The process of preparing a hide is as follows:—

The skin is soaked a day and a night in water, then taken out and scraped.

Then spread hair downwards on straw, and after rubbing the upper side with 1 chitak of "sujjee" and 1½ seers of lime, and a little water, it is tied up with the "sujjee" and lime inside.

It is then soaked for 6 days in 2 seers of lime and water, after which it is rubbed on both sides with broken-up earthenware. This is repeated at intervals till the hair is all off.

It is then taken out, well washed and scraped, and has now become "an adhauri," or untanned leather.

The tanning process then begins. Well bruised "kíkar" bark ("jhánd" is also used, but not considered so good) is soaked in water and the hide thrown in. When the tannin has left the bark, fresh bark is put in. This takes some days, after which the hide is sown up with "moonj," an aperture being left at one end, and hung up, the open end being uppermost. It is then half filled with bruised bark

and water poured in, which as it drops out is caught in a vessel and poured back into the skin: this is continued until the lower part, when pricked, shows the color of leather. The open end is then sown up, the other end opened, the skin inverted, and the process repeated with fresh bark, until the whole is tanned.

The skin is then well washed, rubbed with the hand and dried in the sun. It is then soaked in water with bruised mádar plants.

Tíl oil is then rubbed over it, and it is again soaked a day in water.

Then dried, sprinkled with water, rolled up, and beaten with clubs.

It is then rubbed on the flesh side with a stick, called a "weang," made from the wild caper (*Capparis aphylla*). The whole process, in the hot weather, takes about 26 days; in the cold, about 8 days longer.

Just before the skin is used, it is soaked for a day in a little water with a chitak of alum, 4 chitaks of pomegranate bark, a chitak of salt, and a chitak of "tíl oil." During the day it is several times well twisted.

1724.—Bark of the amaltás, Indian laburnum (*Cassia fistula* or *Cathartocarpus fistula*).

Besides the well-known properties of the fruit or seed pods, this tree yields an astringent bark, much valued for tanning purposes in those places where it can be obtained; but it is nowhere very common.

Samples were sent from—

(4608) Jhilam.

(4697) Gugaira.

1725.—[4542]. Sakí, the astringent bark of a tree (unidentified). Amritsar.

1726.—[4698]. Máín, tamarisk gall. Gugaira.

These are also used in tanning as well as dyeing, wherever they are plentiful. They are of two sorts, great (*barí*) and small (*chotí*). They are not, however, different species, only the large sized galls are collected separately

1727.—[4703]. Bark of the chír, (*Pinus longifolia*). Thandyání hill, Hazara.

This is a remarkable specimen of pieces of bark of great lightness, but immense thickness, being formed by a series of almost cork-like layers, till the bark is nearly four inches thick.

1728.—[4704], Leaves of the bán (*Rhus cotinus*). Abbotabad, Hazára. (Not to be confounded with "bhán," *Quercus*).

1729.—[4692-93]. Juice of the ak (*Calotropis Hamiltonii*). Lahore.

There are two samples—one, of the fresh milk-like juice; the other, a sample which has been mixed for leather-working purposes, with a quantity of salt. It has a most offensive smell.

1730.—[4117]. Kath, extract of *Acacia catechu.* Lahore.

Also a specimen of the "kath gulábí," pink colored, or 1st quality catechu (4108).

The *Acacia catechu*, is "khair" tree, is found in some of the lower hill districts of the Punjab; but the "kath," an extract to be found in the bazars, is generally imported from the N. W. Provinces and Hindústán.

A full description of the process is given in MADDEN'S "Account of the Outer Hills and Tarai of Kumaon." Journal of the Asiatic Society—June, 1848, p., 563.

"The manufacture of catechu is carried on by men, women, and children, the manufacturers being distinguished by the appellation 'khairí.' The men go forth to search for the trees which are best for the purpose, and fell them. A 'khair' tree, good for yielding catechu, is known by having an abundance of red heart wood. The trees being felled the wood is cut into chips. Long shallow furnaces, with covered convex roofs are erected under sheds. The convex covering of the furnace is pierced along the centre to admit of about twenty ordinary earth gharas being placed over the fire.

"The gharas are filled with chips and water, and boiled till the contents of the 20 pots will only fill two. The liquid infusion looks like thin port wine. This is set aside to cool, and the 'kath' or catechu, coagulates and crystallises over leaves and twigs thrown into the pot for the purpose. Each pot yields about a seer of an ashy whitish color.

"Women and children are employed to watch the boiling pots during 20 hours; this is managed by relays of people. The chips of wood after the catechu has been extracted are dried and used for fuel. Each furnace pays a tax of Rs. 4 to Government. The 'kath' manufacture is carried on until the rainy season begins.

"The best sample of catechu are clean and whitish, or pink color, but some are in dirty pieces much mixed with earth—this is inferior. A catechu is obtained by boiling down the nuts of the areca palm (*Areca catechu*) a thick liquid is obtained, which is inspissated, and forms the catechu of commerce."

I find the following notice of catechu in DRURY'S Useful Plants of India."

"It is occasionally mixed with plaster to increase its adhesion, and is also, in conjunction with certain oils, applied to beams to preserve them against the white ants. The most celebrated catechu is that obtained from Pegu, and this brings £4 or 5 a ton more than other astringent extracts. Catechu contains a greater proportion of tannin than other astringent substances, and it has been found that 1 lb. of this is equal to 7 or 8 lbs. of oak bark for tanning purposes. The manufactured article is brought down in considerable quantities from Berar and Nepaul, and thence to Calcutta, from whence it is exported to Europe. In four years ending in 1856 were exported from Madras 5,419 cwt. of catechu, valued at 34,657 rupees, chiefly to the United Kingdom, Bombay, Ceylon, France and Maldive Islands.

"Other kinds of catechu are prepared in India, the commonest of which is that from the nut of the areca palm (*Areca catechu*).

"It is much used as a medicinal astringent substance. As a timber, the wood of the tree is less hard and durable than that of other species of *Acacia*."

REPORT ON TANNING SUBSTANCES.

CLASS IV. SUB-CLASS (D).

THE JURY CONSISTED OF THE FOLLOWING GENTLEMEN:—

MR. R. H. DAVIES,
MR. R. E. EGERTON,
MUNSHI HARSUKH RAI,
SIRDAR JASSA SINGH,
DR. BROWN (*Chemical Examiner*).

REPORTER.—MR. BADEN POWELL.

THIS class forms the last of the series of substances used in manufacture submitted to this Jury. The articles contained in the Sub-division are few and unimportant.

The process of leather dressing commonly followed is only adequate to the production of a coarse but strong leather. There is no demand among natives for anything like a fine leather. Their shoes, if common, are made of thick bullock's leather of its natural brown color; if fine shoes are required, there is no resort required to kid, patent polished leather, &c., the demand for which, has in Europe improved the processes of leather dressing; but cloth and gold embroidery take their place.

So with native saddlery and harness, cloth and gold thread confer the costliness and quality of the work, where in Europe we expect first-rate leather and beautiful finish. Almost the only demands for leather among natives, are for a rude and coarse kind: the shoes of the poorer clases, the water bags of the bheestie, parts of harness, and leather water vessels, are almost the only objects to which leather is applied. The hides prepared by the ordinary process are strong enough for these purposes, and there is no attempt to improve and to progress towards the processes of varnishing, enamelling and polishing.

The most pretentious forms of leather are the red goat skins of the Kangra district, used for bookbinding, and some of the leathers at Peshawur, where a good black leather is made and some green colored leather also.

The materials for these simple processes are consequently few. In the Plain districts, the *Acacia* bark comes most readily to hand, and being quite suitable is used: the bark of the "jhand," in wild jungly districts, is also astringent, and therefore used. In the Hills and sub-montane districts, there is slightly more variety. Species of *Rhus* and *Conocarpus*, with astringent leaves and bark are used, and the oak of the hills also yields a pure tanning material. Samples of these are sent both from the Simla and Hazara forests.

A specimen of acorn-cups, and the astringent principle extracted from them, were sent from Simla, but unfortunately they could not be found in the collection, and so escaped the notice of the Jury.

One of the most valuable products is the "kath," or catechu, obtained from the *Acacia*

catechu, by inspissating the infusion of the wood chips. "Kath guläbí" is the pure and superior article, of a pink or whitish color, while common "kath" is the inferior article much mixed with earth and twigs. There is no sample of the areca palm catechu, but some of the samples under the head of Gums, and called "mochras" were found to be black and highly astringent galls, like excretions of the areca palm. These are sometimes called "phúl súpyári" (flowers of the betel nut), but are only used in medicine.

A solitary specimen of the "malla bark" (*Zyzyphus nummularia*) was sent from Jhilam, and the stringent bark of the "amaltás" (*Cathartocarpus fistula*) completed the collection of barks.

The juice of the "ak" plant (*Calotropis*), is used in the process of dyeing leather red, and is for that purpose combined with salt. There is no specimen that calls for any special mention, beyond the tannin of Simla, which it is much to be regretted did not appear, and the curious light bark of the "chír" from Hazara.

B. POWELL,

Reporter to the Jury.

CLASS IV. SUB-CLASS (E). TEXTILE AND FIBROUS SUBSTANCES FOR PAPER, BASKETS, ROPE, &c., &c.

Fibres are either cellular in their structure like the cotton, *Bombax* cotton, mádar fibre; or consist of woody tissue or fibre like the lotus fibre, flax, hemp, jute, san, &c., &c., but the cellular fibres are not the product of stem or leaves, but of the seed vessels, &c. Plants whose stems and leaves are simply formed of cells or vessels, yield no fibres.

Of the great divisions of plants, classed according to their growth, the first or *Acrogens*, whose growth is at the summit by the junction of the base of the leaves at the top of the stem—none yield fibres.

The second, *Endogens*, which grow from inside, that is the leaves (whose venation and fibres are parallel and longitudinal, like the fibres of their true stems) enter the cellular system of the stem, and are thence pushed outwards by new growth from the inside, like all aloes and palms, which have no regular bark, but a hardened outside, caused by the leaves being pushed out, by the tier which springs above them from the inside, and that tier again by another, and so on. Of this class, the leaves of many species of pine apple, *agave*, &c., yield valuable fibres, by removal of the vascular and cellular portions by means of pressure and washing; or, as in the case of grasses, the fibre and cellular are allowed to dry together, the leaf not being succulent enough for the sap to promote the decay of the fibrous portion; these grasses then make strong ropes. *Exogens*, which grow from the outside, by rings forming as on trees, have regular bark. The outside is cellular and useless, but has fibres inside which, when the bark is peeled off, can be separated, as in jute, flax, hemp, &c. This is very well exemplified in the structure of the hemp stalk. At the centre we have a hollow, or a light pith; the pith is next surrounded by a cellular substance with a little woody fibre, this is called, the *reed*, *boon* or *shove* of the hemp. Then comes the series of parallel fibres, which are the valuable part; and then a cellular cuticle, which has to be separated from the fibre by steeping, &c., this answers to the outer cellular bark of exogenous trees. Many barks of trees have the inner fibrous portion so strong and tenacious, and the outer or cellular portion so comparatively reduced, that the bark yields a strong rope material as it is, such are the *Grewia* and *Bauhinia*, and "dhák" bark ropes, &c., &c.

This large and important class may be subdivided for convenience of reference into—

I. Textile fibres—those suitable to the production of cloth, &c.—Cotton, flax, mádar fibre, nettle fibre, and a few rarer ones.

II. Fibres suited for making ropes and mats.—San, hemp, sanukra (*H. cannabinus*), aloe fibre, múnj grass, &c.

III. Fibres suited for paper making—*Daphne, Desmodium*, &c.

IV. And somewhat separated from the first, substances used in platting and making mats, fans, and baskets, and in thatching roofs.

It is not intended that fibres distributed under each head serve for no other purpose but that therein indicated; as a rule the fibres in any one division serve more or less for

the purpose of the other divisions below it, except perhaps the last or fourth, which is on the verge of being out of the province of fibres (properly so called), altogether; for instance, cotton, though distinguished by its prominent quality of affording a series of fabrics will, nevertheless, yield a good rope, and its rags, a good paper. The same with flax and the rest.

Taking then the fabrics under these divisions we have specimens as follows:—

I. TEXTILE FIBRES.

1731.—Cotton (*Gossypium herbaceum*, and allied species). *Vern.*—Rúí (Hind.); rúñ (Punjabí); pambah (Persian); kurtam (Arab.) The plant, kapás or kapáh. The seed alone, banaulah, kapáh bíj.

Space forbids me to enter on a consideration of the evidence as to cotton being indigenous to India or not, but at the same time the question has been so well discussed, that it will be hardly too much to assert that there is every reason to believe that species of cotton *are* indigenous to India, and also to America; but that the species now recognized as American differ in character from all the known Indian species.*

The earliest name by which the ancients of Europe were acquainted with cotton is "carbasos." Evidently the Sanscrit "karpasi;" and not only have we STRABO's accounts of cotton fabrics in India, but HERODOTUS in his account of the Indians, mentions that "they possess a kind of plant which, instead of fruit produces wool of a finer and better quality than that of sheep, of this the natives make their clothes."

The same author makes no allusion to cotton in Egypt, though he pointedly does to linen; and no cotton fabric has ever been found on Egyptian mummies.

PLINY† indeed speaks of a plant called "gossypium," having a nut, from the inside of which a wool‡ is obtained; but this author did not write till 500 years after HERODOTUS, and cotton was in that space probably introduced by reason of the Indian trade.

Besides the indigenous species of cotton (*G. indicum*) of late years other varieties have been introduced, such *G. barbadense*, the source of Sea Island, Upland Georgia and New Orleans§ cottons; *G. peruvianum* of Mexican and Peruvian cotton; *G. hirsutum* of Shanghai or Nankin cotton. All these varieties have succeeded and acclimatised more or less well; the Sea Island kind perhaps being an exception.

The distribution of cotton over the world is very remarkable, and is thus described by ROYLE.*

In a cultivated state, cotton is now distributed over a very wide expanse of the globe on both sides of the equator: on the north, extending as far as the Southern shores of Europe, and on the south to the Cape of Good Hope; in the islands of the Pacific Ocean, it is found both in the Friendly and the Society Islands. Nearly under the line, it is cultivated in the islands of Celebes, Java, Timor, and the Seychelles, as well as in Kutung, where the best is said to be grown, extending northwards up the Malayan Peninsula, along the coast of Tenasserim into the Burmese territory, and from this westward, into Siam and China, whence there is a peculiar species. Cotton is common in every part of India; a wild species was found in Ceylon, and another in Silhet by DR. ROXBURGH. From India the cotton seems to have travelled by the way of the Persian Gulf into Arabia, as well as into Persia, and from thence to Syria and Asia Minor. From Arabia and from the ancient commerce by the Red Sea with India it was probably introduced into Egypt, whence it seems to have spread into the interior of Africa, and to both its western and northern coasts. The islands and shores of the Mediterranean long supplied Europe with all the cotton it required; during the reign of NAPOLEON, he caused it to be introduced into Corsica, Italy, and the southern parts of France; and MR. KIRPATRICK cultivated it in Spain, near Malaga. In America, cotton is extensively cultivated in the Spanish, Portuguese, Dutch, and English settlements; also in Mexico and the Southern States, as Georgia and Carolina of the United States of North America. One species is peculiar to Peru; others are cultivated in the West Indian Islands.

In the case of cotton, where varieties introduced from other countries are confessedly our greatest hope, it becomes of first rate importance to notice the conditions under which the best varieties thrive.

We cannot hope to arrive at any general principles that will equally apply to all cotton crops, since the conditions under which cotton will grow are so widely different. HUMBOLT saw cotton on the Andes, at

* ROYLE's Illustrations, I., p. 86.

† Lib. 19-1., quoted by ROYLE.

‡ It is remarkable that this idea of vegetable wool is preserved in the German, Dutch, and Swedish names for the cotton plant—Baumwolle, Boomwoll, Bomold.

§ BIRDWOOD, Bombay Products. 315; Saharanpoor Catalogue (JAMESON), p. 72.

* Illustrations p. 86.

9000 feet; on the Himálaya it is found at 4000. Cotton flourishes also in the rich basaltic soils of Central India, and again on the sea-shore tracts of the Sea Islands. But conditions favorable to development can be noticed, and methods of cultivation indicated.

HUMBOLDT gives as the zone of production for the species *G. barbadense, hirsutum,* and *religiosum* as from 0° to 34° of latitude. But *G. herbaceum* grows up to 37° in America, and to 46° near Astrakan.*

The British possessions are all within these limits, extending from 8° to 31°.

As to atmospheric conditions affecting its growth, it is quite unsafe to enter on specialities. No differences could be conceived greater than must exist between the Andes at 9000 feet, the plains of Central Peru at sea level; between the sea coast of the Sea Island, the plains of the Sind Ságar Doab, and the districts of Tinevelly; yet in all these cotton of excellent quality is produced.

But though such general principles of latitude and climate cannot be established with regard to cotton, there are principles which can, and these are well pointed out by DR. ROYLE in the following passage:—

"Much, therefore, may be done in improving the kinds which already exist in India, by ascertaining with precision the parts of the country where the best cotton is already produced, the peculiarities of soil, climate, and culture: by selecting the most prolific plants, and extending their cultivation, to the exclusion of less fertile and inferior kinds; exchanging the produce of one place with that of another, when others can be induced to take the same trouble in selecting and preserving only the best kind of seed. Doing in fact, what is everywhere done by all who are interested in the improved cultivation of grain, vegetables, fruit or flowers; though some varieties are difficult to propagate by seed, yet others may be continued sufficiently long to attain the permanency of species, instead of the liability to change of varieties.

"Much, moreover, may be effected by introducing into India the different species and varieties which are already successfully cultivated in other countries; and here the chief thing is not to restrict ourselves to too small a number of varieties, because they happen to be those which at present produce the best kinds of cotton. Not contented in America with possessing already the best kinds of cotton, they have tried those of other countries to see if there were not among them some suited to the peculiarities of their country and climate."

* ROYLE.

Following out these principles, much has been done of late years to import good seed and distribute it. The kinds have been principally—New Orleans and Georgian, a little Mexican and Nankin, and some Egyptian seed; the Sea Island seed has failed.

Much also has been done to improve the cultivation; and clear and simple instructions has been translated into the vernacular, and printed for distribution.

The native cotton is chiefly distinguished by its short staple and somewhat coarse fibre; it is sown by a most wasteful process broad cast, whereas the simple plan of making holes in lines at fixed distances apart, and dropping 4 or 5 seeds into each, is found not only to consume far less seed, but to produce much more healthy and satisfactory plants.

The native method of cultivating cotton is much the same everywhere, and broad cast sowing is equally in vogue. MAJOR CLARKE'S account of cotton cultivation, which may not be easily accessible to many readers, is here extracted.

"Cotton is sometimes cultivated as an unirrigated crop in the villages on the edge of the bar, and within it, it is also occasionally kept on for a second year's crop, the latter being un-irrigated; as a primary process, the land is well ploughed three or four times, and then levelled. In "chahi," or irrigated lands, a portion of the land ploughed for the wheat crop is reserved for cotton; sometimes, indeed, the young wheat is ploughed in twice, the land levelled, and the cotton seed mixed with dried and powdered cow-dung sown broad cast in the month of Phágan; four hand-hoeings are given, some cultivators manure before, some after, sowing. The seed when first sown requires but little watering, subsequently water must be given every fifth or sixth day. The first gatherings begin in Asauj or Kartak, according as the crop may be of the first or second year's growth. In this perguna the cotton is gathered every eighth day, in many others every fourth day. The average quantity of seed is eight seers per acre; a cotton gatherer (girl or woman) receives one seer of cotton per diem; sometimes it is gathered at one-eighth of the produce, which averages:—

"In khadir lands, ...	6 mds.	per acre.
Bangar ditto, ...	8 „	„
Lands bordering on or within the bar, ...	10 „	„

"The gathering is continued to the end of Maghar."

Of such cultivation the profits and costs are calculated by the same writer, as follows, on 2 acres of cotton:—

Produce.	R.	A.	P.	Cost.	R.	A.	P.
First-rate crop, 24 maunds, ..	48	0	0	Revenue, 12 to 16, say, ...	16	0	0
				Putwari, ...	0	8	0
				Lumberdarí malba, ...	1	9	6
				Road Fund, ..	0	2	6
				Seed, 16 seers, ..	0	8	0
				Hand-hoeing, at six annas per kanál, ...	8	0	0
				Gathering cotton, at 18 seers per kanál, ...	14	6	6
				Rupees, ..	39	2	6
Total, ..	48	0	0	Gross profits, Rs.,	8	13	6

The total area under cotton cultivation in the Punjab was in 1861, 547,414 acres, against 481,351 the year before, and 467,500 before that.

In the Punjab Proper the sowings begin as early as February 18th, and go on till the end of March, and in well watered (chahi) lands, to April and May.

In Delhi division the sowings extend into July, and do not begin till the middle of May, at the earliest.

In Dera Ghází Khán the sowings are late, as the crops are dependent on the rise of the inundation canals.

The picking is in October, November and December, and sometimes begins as early as September, frost and excessive cold being injurious. The cotton should be all picked before January.

The cotton plants generally last one year only; if they grow for a second crop, the produce is less than the first year by from one-third to one-fourth, but ripens somewhat earlier.

In Dera Ismaíl Khán and Bunnoo, the plants stand for three years, and the second year's crop is the heaviest.

The power of the cotton plant to sprout up again, and bear fruit year after year, is curiously illustrated by what took place at Gurdaspúr. In Batála, about 7 or 8 years ago, a distribution of good seed was made by J. H. Prinsep, Esq., and the people who received it still grow plants therefrom. This plant when properly treated does not deteriorate. There are 5 or 6 plants in Gurdaspúr, 5 years old, which fruit annually, with but slight difference in quantity and quality. The plants require the roots to be loosened and watered, and occasionally manured in proper seasons, and when the plants are healthy, the produce is close on 8 maunds per acre.

From recent returns, it was observed that the districts of Rawalpindi and Amritsar showed the greatest area cultivated with cotton, and Peshawur the least; Rohtak, Gurdaspúr, and Ambálah may have the greatest area in proportion to other crops. In Simla and Sirsa cotton was hardly grown at all.

The late Exhibition, however, contained samples from several of the Hill States of Simla.

The quantity of cotton exported is not at all in proportion to the produce. Out of 540,000 maunds produced, it was said that less than 100,000 maunds reached Calcutta and Bombay.

The land exports of cotton are from Delhi—to Rohilkund to Benares and Calcutta.

Gurgaon, Kurnal } Mirzapúr and the Punjab Proper.

Rohtak—Punjab Proper and Lower Provinces.

Jálandhar—to Hushyarpúr, Kangra and Firozpúr.

Sealkot—to Multán, Jammú, and the Salt Range.

Gurdaspúr—to Lahore.

Lahore—to adjoining districts.

Gujranwalla—to Sindh, the Salt Range, and Peshawar.

Rawalpindi—to Peshawar and Kuhát.

Gujrát—to Kashmir and the Salt Range.

Shahpúr—to Kábul, Jhang and Múltán.

Múltán—to Karáchi, Bombay, Deraját and Bháwalpúr.

Muzaffargarh—to Sindh.

Derajat and Bunnoo—across Sulaimaní Hills to Sindh—also to Káráchí and Bombay, and to Peshawar, and Kuhát.

Hazára and Peshawur—to Afghanistán, Swát, &c., &c.

I have taken occasion to reprint two valuable statements, showing the yield of cotton crops in the Punjab. The first shows the results of the years 1861-62. In this table, it should be added, that the averages produce per acre varied from 3 maunds (240 lbs.) in Hushyarpúr to 16 seers (32 lbs.) in Kangra.

The second table is a very complete one, published in the Financial Commissioner's Circular, No. $\frac{20}{1100}$ dated 9th March, 1867. The table shows the comparative results in the years 1864-65-66.

Division.	District.	Probable total produce of cotton fibre during 1861.	Quantity of cotton without the seed gathered from the late crops.	Quantity retained for home use.	Quantity exported.	Average price per maund.		
		MDS.	MDS.	MDS.	MDS.	RS.	A.	P.
Delhi.	Delhi, ...	11,050	8,179	6,359	1,820	12	8	0
	Gurgaon, ...	37,308	25,310	13,310	12,000	14	0	0
	Karnal, ...	22,957	16,038	10,692	5,346	12	8	0
	Total, ...	71,315	49,527	30,361	19,166	..		
Hissar.	Hissar, ...	7,272	8,275	8,275	..	13	8	0
	Rohtak, ...	48,174	33,448	15,558	17,890	14	0	0
	Sirsa, ...	158	..	..	..	..		
	Total, ...	55,604	41,723	23,833	17,890	..		
Ambálah.	Ambálah, ...	49,738	36,000	8,000	28,000	14	0	0
	Ludhiana, ...	45,422	47,000	10,500	36,500	14	8	0
	Simla, ...	250	..	..	..	..		
	Total, ...	95,410	83,000	18,500	64,500	..		
Jálandhar.	Jálandhar, ...	19,660	23,623	17,283	6,340	13	9	4
	Hushyarpúr, ...	18,025	21,000	21,000	..	13	5	4
	Kangra, ...	4,476	..	..	..	..		
	Total, ...	42,161	44,623	38,283	6,340	..		
Amritsar.	Amritsar, ...	32,290	12,220	8,480	3,740	14	0	0
	Gurdaspúr, ...	21,928	28,712	18,807	9,905	16	0	0
	Sealkot, ...	30,332	20,631	12,641	7,990	18	0	0
	Total, ...	84,550	61,563	39,928	21,635	..		
Lahore.	Lahore, ...	16,428	12,144	7,894	4,250	18	0	0
	Gujranwalla, ...	18,107	15,000	10,000	5,000	17	0	0
	Ferozpúr, ...	12,000	10,473	3,700	6,773	17	8	0
	Total, ...	46,535	37,617	21,594	16,023	..		
Rawalpindi.	Rawalpindi, ...	13,963	13,091	10,391	2,700	16	0	0
	Jhilam, ...	15,676	16,000	16,000	..	15	2	3
	Shahpúr, ...	27,093	21,622	5,329	16,293	17	0	0
	Gujrát, ...	21,156	20,998	7,473	13,525	17	0	0
	Total, ...	77,888	71,711	39,193	32,518	..		
Múltán.	Múltán, ...	26,325	16,815	8,351	8,464	16	9	10
	Jhang, ...	21,016	15,393	9,180	6,213	16	0	0
	Gugaira, ...	11,870	8,912	6,998	6,914	18	4	0
	Muzaffargarh, ...	15,997	14,200	4,600	9,600	17 to 20	0	0
	Total, ...	75,208	55,320	29,129	26,191	..		
Deraját.	Dera Ismail Khán, ...	14,238	6,500	2,560	3,940	23	0	0
	Dera Ghází Khán, ...	16,146	17,130	5,000	12,130	25	0	0
	Bunnoo, ...	5,182	4,495	2,332	2,163	24	0	0
	Total, ...	35,566	28,125	9,892	18,233	..		
Peshawur.	Peshawur, ...	9,918	13,790	7,030	6,760	20	2	8
	Hazara, ...	7,240	4,207	4,207	..	16	0	0
	Kohát, ...	1,069	2,475	995	1,480	26	8	0
	Total, ...	18,227	20,472	12,232	8,240	..		
	Grand total, ..	6,02,466	4,93,681	2,62,945	2,30,736	..		

With reference to the second table which follows, the circular quoted makes the following statement.

"The information relates to the season ending with the autumn of 1866, when the crop is ready to be picked. Though the replies were not received in a complete state till recently, they are based on information derived before the out-turn of the season could be known, and before the effect of the recent and still existing drought could be determined. It s therefore quite possible that the actual out-turn is not only less than the preceding year, but less than was at one time anticipated with regard to the season under report.

"As to ascertain the actual out-turn would only cause further delay, the information already obtained is published as it is, and may be accepted for what it is worth.

"The area under cotton cultivation is shown to be 624,193 acres. The area shown in last year's report was 625,035, which is amended in the present report to 613,262. There has therefore been an increased area sown—but the area is still only about three-fourths of what it was in 1864-65, when the cotton trade was at an unnatural height.

"The fact that there is no falling off in the area sown shows that the cultivation is one steadily relied on by agriculturists. The violent re-action which followed the close of the American war and the failures in Bombay has now been fairly tided over, and unless some convulsion of similar character should recur, of which there seems to be no reasonable apprehension, the cultivation is likely to maintain a steady position.

"The prices of the past year do not show such violent fluctuations as they did in the two preceding years.

"The average wholesale price for the province is shown to be Rs. 16-2-6 per maund, against Rs. 20-12-7 the preceding year. The average founded on the averages of the ten divisions is nearly the same as that founded on the figures of the 32 districts, but if the details be scrutinised, it will be seen that there are great differences between districts, even within the same division. Thus, for instance, in the Múltán district, the wholesale price reached Rs. 30 a maund, and in Muzaffargarh it reached Rs. 25—but in Montgomery and Jhang, within the same division, the price was only Rs. 18. Similarly, in Gurdaspúr the highest wholesale price was Rs. 22, while in the neighbouring district of Sealkot it was only Rs. 15.

"The lowest wholesale prices, as may be expected, do not show such great variations as the highest, as a minimum value is more easily found than a maximum. Except in the Peshawur division, which shows an exceptionally high rate, the lowest wholesale price may be said to range from Rs. 10 to 14 a maund.

"The Deputy Commissioner of Ambálah remarks, that when the English price for fair Bengal cotton is at 8*d*. a pound, equal to Rs. 26-10 a maund, there would be an ample margin for profit for cotton priced here at Rs. 14 to 16 a maund. It may be inferred therefore, that cotton has not, during the past year, fallen in price below that point when it would cease to be remunerative. In cases where prices ranging from Rs. 20 to 30 a maund have been realized, the profit on the transaction must have gone to the producer, and where the local purchaser has obtained the cotton at from Rs. 10 to 14, the lowest wholesale rates, the profit must have been secured chiefly by him; even on the average rates, both the producer and the local purchaser must have been secured from loss.

"Only one officer, the Deputy Commissioner of Jhilam, alludes to advances made by money lenders to cultivators, and considers that one reason for the great falling of in area in his district is that the money lenders no longer find it so profitable to encourage agriculturists to grow cotton on their account by means of advances. The Rawalpindi division produces more cotton than any other, but the same falling off is not observable in the other three districts that has occurred in Jhilam. Most of the other divisions, and, in particular, Delhi and Ambálah show a large increase.

"It may be noted here that, while in the Punjab returns, the out-turn is shown as less than a maund an acre, in the North West Provinces the out-turn is usually rather more than a maund an acre.

"Precise information has not been obtained as to whether local demand for local consumption has increased, but it seems probable that it has, as local consumers could not afford to buy much cloth when the price was at its height last year and the year preceding, and as the price has fallen they have probably purchased more largely for private use.

"It was estimated last year, that the area under cultivation would yield about 500,000, or somewhat more than three-fourths of a maund an acre; owing to the drought it is not likely that the out-turn of the present year has been so great. It may be estimated about 400,000 maunds. Last year it was calculated that about half the entire quantity would be available for export. This year, it seems likely that, as the English price has fallen, and the local demand has increased, a smaller amount will be available.

"It has been ascertained from the annual returns of the Boat Trade on the Indus, furnished to this office, that about 100,000 maunds of cotton were carried down the river during the year 1865-66. Re-

turns obtained from the Agents of Steam Companies in Múltán show that in 1865-66, the quantity of cotton carried down the Indus was 158,966 maunds, of which the Indus Flotilla Steamers carried 96,495, and the Oriental Inland Steam Navigation Company's Steamers, 62,471. This added to the 100,000 maunds reported to have been carried by boats, gives the total export as 259,976, which is almost exactly the amount estimated by the Financial Commissioner in last year's report.

"The export by steamer has increased greatly of late years, as the following figures of the Oriental

1862-63.	1863-64.	1864-65.	1865-66.
Maunds.	Maunds.	Maunds.	Maunds.
19,837	50,748	14,798	62,471

Steam Navigation Company will show. The figures of the Indus Flotilla for those years are not available.

"The returns of the Fírozpúr bridge-of-boats show that cotton is chiefly carried down the river in the first quarter of the year. The quantity carried from July to December 1865, was only maunds 8,281, while in the three months of January, February and March 1866, the quantity was 43,467 maunds. The total for the year ending 30th April, 1866, was 64,421 maunds. This quantity is included in the lakh of maunds registered at Mithankote.

"If the out-turn of cotton is anything like what it was last year, or say, allowing for unfavorable weather, 450,000 maunds, it may be estimated that about 200,000 maunds will be available for export, and the most of this must be already on its way down the Indus."

STATEMENT showing the estimated extent of cotton cultivation in the Punjab.

1	2	3	4	5	6	7						8						9						10
Division.	District.	Area estimated for 1865-66 (acres).	Rain-fall from 1st May to 1st November 1865.	Rain-fall from 1st May to 1st November, 1866.	Area estimated for 1866-67 (acres).	Highest wholesale prices of cotton per maund.						Lowest wholesale prices of cotton per maund.						Average wholesale prices of cotton per maund.						Abstract of remarks of Deputy Commissioners, as to present condition of crops and the prospects of a favorable out-turn or otherwise.
						1864-65.			1865-66.			1864-65.			1865-66.			1864-65.			1865-66.			
DELHI.	Delhi, ...	12,648	27	26	17,729	35	9	0	16	0	0	8	0	0	8	5	0	21	12	6	12	2	6	A favorable out-turn anticipated.
	Gurgaon, ...	10,989	25	31	33,172	25	0	0	16	0	0	18	0	0	13	0	0	21	8	0	19	8	0	Prospects favorable in perganahs Noh, Ferozpúr and Pulwal, but unfavorable in Jharsa and Rewarí for want of rain.
	Karnal, ...	15,874	22	15	19,165	25	0	0	15	0	0	6	8	0	10	0	0	15	12	0	12	8	0	Though the area brought under cotton is more than in the preceding years, yet the out-turn of the crop is below the average, owing to dearth of rain.
	Total, ..	39,511	..	..	70,066	35	9	0	16	0	0	6	8	0	8	5	0	19	10	10	14	11	6	
HISSAR.	Hissar, ...	8,993	23	10	9,385	32	0	0	25	0	0	12	0	0	10	0	0	22	0	0	17	8	0	The present condition of the crop is bad owing to want of rain.
	Rohtak, ...	16,913	17	11	35,397	27	0	0	17	0	0	8	0	0	11	0	0	17	8	0	14	0	0	Ditto ditto ditto.
	Sirsa, ...	..	16	11	225	28	0	0	18	0	0	12	0	0	10	10	8	20	0	0	14	5	4	This is not a cotton producing district.
	Total, ..	25,906	..	..	45,007	32	0	0	25	0	0	8	0	0	10	0	0	19	13	4	15	4	5	
AMBALAH.	Ambálah, ...	27,067	37	23	38,258	27	0	0	20	0	0	11	0	0	10	0	0	19	0	0	15	0	0	A fair average out-turn is expected.
	Ludhiana, ..	7,701	15	19	9,414	19	0	0	18	0	0	12	0	0	14	0	0	15	8	0	16	0	0	About ⅓ of the cotton will be used in the district and ⅔ exported.
	Simla, ...	3,050	56	47	3,192	28	1	0	20	0	0	7	0	0	5	0	0	17	8	6	12	8	0	No remarks.
	Total, ..	37,818	..	..	50,864	28	1	0	20	0	0	7	0	0	5	0	0	17	5	6	14	8	0	

1	2	3	4	5	6	7		8		9		10
Division.	District.	Area estimated for 1865-66 (acres).	Rain-fall from 1st May to 1st November, 1865.	Rain-fall from 1st May to 1st November, 1866.	Area estimated for 1866-67 (acres).	Highest wholesale prices of cotton per maund.		Lowest wholesale prices of cotton per maund.		Average wholesale prices of cotton per maund.		Abstract of remarks of Deputy Commissioners, as to present condition of crops and the prospect of a favorable out-turn or otherwise.
						1864-65.	1865-66.	1864-65.	1865-66.	1864-65.	1865-66.	
JALANDHAR.	Jálandhar, ..	26,543	20	21	27,697	18 0 0	19 0 0	11 4 0	12 0 0	14 10 0	15 8 0	Aspects of the crop are medium, owing to want of rain.
	Hushyarpúr, ..	33,970	25	26	25,855	32 0 0	20 0 0	14 0 0	12 0 0	23 0 0	16 0 0	Condition of crops good, and a favorable out-turn expected, though the area sown is less than last year.
	Kangra, ...	15,141	81	47	4,250	20 0 0	20 0 0	20 0 0	10 0 0	20 0 0	15 0 0	The small cultivation this year is owing to want of rain at the proper time, but the crop is good.
	Total, ..	75,654	..	..	57,802	32 0 0	20 0 0	11 4 0	10 0 0	19 3 4	15 8 0	
AMRITSAR.	Amritsar, ..	36,292	19	22	24,391	29 0 0	20 0 0	12 5 3	12 2 3	20 10 8	16 1 2	
	Gurdaspúr, ..	No records kept of this year's return.	13	27	24,706	20 0 0	22 0 0	12 0 0	14 0 0	16 0 0	18 0 0	Prospects good.
	Sealkot, ...	37,350	19	28	34,677	16 0 0	15 0 0	11 0 0	12 0 0	13 8 0	13 8 0	
	Total, ..	73,642	..	..	83,774	29 0 0	22 0 0	11 0 0	12 0 0	16 11 7	15 13 9	
LAHORE.	Lahore, ...	31,971	16	11	43,341	32 0 0	19 0 0	14 0 0	10 0 0	23 0 0	14 8 0	Every prospect of a good crop.
	Ferozpúr, ..	15,792	35	10	11,835	28 0 0	20 0 0	11 0 0	10 0 0	19 8 0	15 0 0	Present condition of crop very poor for want of rain, out-turn will be much below the average.
	Gujranwalla, ..	24,174	22	19	22,465	17 0 0	15 0 0	12 0 0	13 0 0	14 8 0	14 0 0	
	Total, ..	71,937	..	..	77,641	32 0 0	20 0 0	11 0 0	10 0 0	19 0 0	14 8 0	

RAWALPINDI.	Rawalpindi, ..	28,455	16	21	26,934	27	0	0	20	0	0	14	0	0	10	0	0	20	8	0	15	0	0	Crops have suffered for want of timely rain, out-turn unfavorable.
	Jhilam, ..	41,620	26	18	24,731	33	0	0	18	0	0	21	8	0	13	8	0	27	4	0	15	12	0	The yield this year is small, owing to want of rain during August and September.
	Gujrát, ...	41,634	22	22	38,029	25	0	0	16	0	0	13	0	0	12	0	0	19	0	0	14	0	0	Though the crops have suffered from drought in some localities, yet an average out-turn is expected.
	Shahpúr, ..	24,729	10	7	18,643	25	0	0	18	0	0	14	0	0	14	0	0	19	8	0	16	0	0	The out-turn will be very small, owing to the great drought this year.
	Total, ..	1,36,438	..	..	1,08,337	33	0	0	20	0	0	13	0	0	10	0	0	21	9	0	15	3	0	
MULTAN.	Múltán, ..	18,322	1	2	17,207	43	0	0	30	0	0	16	0	0	14	0	0	29	8	0	22	0	0	The crops have slightly suffered this year, owing to the canals having been closed earlier than usual.
	Jhang, ...	15,535	8	3	12,867	21	0	0	18	0	0	16	0	0	12	0	0	18	8	0	15	0	0	The crop is good, but the area under cultivation less than in previous year, want of rain being the chief cause.
	Montgomery, ..	7,871	6	4	11,530	20	0	0	18	0	0	12	0	0	13	0	0	16	0	0	15	8	0	Crop favorable and the out-turn expected will be realized.
	Muzaffargurh, ..	22,430	1	4	29,700	40	0	0	25	0	0	19	0	0	10	0	0	29	8	0	17	8	0	No remarks.
	Total, ..	64,158	..	..	71,304	43	0	0	30	0	0	12	0	0	10	0	0	23	6	0	17	8	0	
DERAJAT.	Dera Ismail Khán,	37,521	2	2	18,893	32	9	4	22	0	0	14	0	0	11	8	0	23	4	8	16	12	0	The out-turn will not be so favorable as in the preceding year, owing to the scarcity of rain.
	Dera Ghází Khán,	13,512	1	5	11,475	38	0	0	25	0	0	15	0	0	10	0	0	26	8	0	17	8	0	The condition of crops good, favorable out-turn is expected.
	Bunnoo, ...	13,429	6	4	8,571	30	8	0	20	0	0	19	0	0	13	0	0	24	12	0	16	8	0	Crops not so good as last year, prospects of out-turn unfavorable.
	Total, ..	64,462	..	..	38,939	38	0	0	25	0	0	14	0	0	10	0	0	24	13	7	16	14	8	

1	2	3	4	5	6	7						8						9						10
Division.	District.	Area estimated for 1865-66 (acres).	Rain-fall from 1st May to 1st November, 1865.	Rain-fall from 1st May to 1st November, 1866.	Area estimated for 1866-67 (acres).	Highest wholesale prices of cotton per maund.						Lowest wholesale prices of cotton per maund.						Average wholesale prices of cotton per maund.						Abstract of remarks of Deputy Commissioners, as to present condition of crops and the prospect of a favorable out-turn or otherwise.
						1864-65.			1865-66.			1864-65.			1865-66.			1864-65.			1865-66.			
PESHAWUR.	Peshawur, ..	13,175	4	4	13,988	29	0	0	23	0	0	20	0	0	19	0	0	24	8	0	21	0	0	Present condition of crops good, prospects of out-turn favorable.
	Kuhát, ...	4,339	9	12	2,846	40	0	0	27	0	0	20	0	0	20	0	0	30	0	0	23	8	0	No remarks.
	Hazára, ...	6,522	21	17	3,625	22	0	0	20	0	0	20	0	0	20	0	0	21	0	0	20	0	0	Prospects unfavorable, out-turn rather below the average.
	Total, ..	23,736	..	..	20,459	40	0	0	27	0	0	20	0	0	19	0	0	25	2	8	21	8	0	
	Grand Total,	6,13,262	..	..	6,24,193	43	0	0	30	0	0	6	8	0	5	0	0	20	12	7	16	2	6	District average.
		..	..	..	..	0	0	0	0	0	0	0	0	0	0	0	0	20	10	9	16	2	4	Divisional average.

FINANCIAL COMMISSIONER'S OFFICE,
LAHORE, *The 9th March*, 1867.

In concluding these notes on cotton culture, it will be well not to overlook the difficulties the farmer has to contend with, hence I extract from the Proceedings of the Agri.-Hort. Society, Punjab, the following notes on *blight* of cotton.

The following papers were forwarded for the consideration of the Society, by the Financial Commissioner.

The first is by Dr. JOHNSTONE of Gujrát :—

"The cultivation of Indian cotton (*Gossypium arboreum*) has during the course of the unfortunate American war, extended considerably in the Punjab; during the last two years cotton-farming by occupying tracts formerly yielding pulse and grain has increased the market rate of these life necessaries. It has moreover yielded an easy and a steady profit, but in common with other plant life, it is liable to disease.

* * * * * *

"Cotton is sown in March and April, and reaped from October to December, from its first growth to seeding it is a prey to parasites.

"1. The larva of the *Helicopis cupido* attacks the sapling in its bud.

"2. The larva of the *Depresearia gossipiella* (weevils), the seeds in harvest; these are the 'toka,' of the natives.

"3. As the rainy season approaches, the hairy caterpillar (bhúngo) appears preying on the stem leaves, but has powerful enemies to contend with. The minar and tilies (Indian starling) feast on them ; the former only to allay hunger, the latter partakes sparsely, but remorselessly destroys multitudes.

"4. The disease which bids fair to destroy ¾ths of this year's cotton crop is 'thela.'

"Ever since cotton-farming, 'thela' has probably occasionally appeared, but with increased cultivation disease has multiplied apace.

"What then is the producing cause of 'thela,' and what its cure ?

"On examining a typical leaf of the cotton plant effected by 'thela' we find—

"1st.—Part of the leaf yellow and crumpled, the nutrient sap being withdrawn, it has withered and died.

"2nd.—Part of the leaf blackened, mortification patches, the stage preceding death.

"3rd.—A quantity of liquid substance resembling oil, hence the native name 'thela.'

"4th.—Part of the leaf frosted with lanuginous tufts.

"5th.—Part of the leaf covered with pale orange insects.

"The zemindars believe when rain is scanty and dew at a maximum, 'thela' is induced, but the *causus morbi* is a viviparous wingless parasite; the Aphis lanigera ; possessing a flask-shaped body, six feet, two antennæ, two tubes at abdominal extremity, a haustellum for puncturing, and a sucker for extracting ; and within this transparent sucker a perfect apparatus resembling a hand-pump ; the sucker is fixed, the minature piston plays, and the sap—the life-blood of the plant—is absorbed.

"The extreme fecundity of the Aphides is remarkable, both sexes only exist in autumn, and one congress with the male yields not only the primary young, but their young for six generations, when both sexes are again generated. * * *

"After pairing, the female deposits eggs, which in about four days animate. Immediately from every pore of their tiny bodies springs a cottony hoariness which daily increases until they are cradled in a downy bed ; while in this snow-white cot,—which at once effectually conceals their nature and protects from climatic change, they prey upon the green leaves ; they are more abundant on the under surface of the leaf, * * * * * where wind-force acts at a minimum upon their fairy feathered forms.

"Increasing with such amazing rapidity the sap is soon exhausted, mortification and blight results.

"As these atomic creatures age, their white plaster coats vanish ; and pale-orange wingless insects appear, the 'koongee' of the Jats.

"When the female Aphis lanigera is crushed, the hand is stained a purplish red. Might she not yield a useful dye ? It is worthy of note that this insect belongs to the same sub-order as the Mexican cochineal (*Coccus cacti*), a parasite of the Nopale (*Cactus opuntia*), and the Indian lac insect, Coccus lacca,—a parasite of the banyan (*Ficus religiosa*); and in these instances the female only yields the dye.

"The 'thela' oily honey-dew found on the leaves, is secreted from the abdominal tubes of the female Aphis, and exists in abundance. Ants prize it, and devour it greedily whenever a colony of Aphides exist ; the red and brown ants (Formica rufa and fusca) wait upon them; should the 'thela' be scanty the ants stroke and fondle them with their antennæ until a supply is secreted.

"With regard to the influence of soil, the Aphis attacks the cotton crop of the 'rohi,' hard compact land, most severely ; the 'mehra,' 'barani,' or soft, damp, loamy soil less so ; and the 'retli' or sandy, least of all.

"In autumn the 'toka' larva of Depresearia gossipiella abounds in the 'retli,' destroying the 'banola' or cotton seed. No parasite preys on the cottony fibre. It is insipid and lacks albumen.

"These parasites may be destroyed or kept at bay—

"I. The larva of *Heliocopis cupido*,—'toka,'—is put to flight by sprinkling ashes over the sapling.

"II. The hairy caterpillar, 'bhúngo,' possesses many natural enemies; if very abundant, pick them.

"III. The larva of Deprèscaria gossipiella's predations can be effectually checked by scalding the banola before storing; this process destroys the larva, but does not impair the vitality of the seed.

"IV. The Aphis lanigera, the originator of 'thela,' does not exist in any cotton field growing in the proximity of hemp, 'sunn.' Some considerable time ago I remarked this in a small field to my own, in part of which hemp, 'sunn,' was growing, and experience has amply confirmed it.

"1. Hemp, 'sunn,' should be sown with cotton in adjacent ruts, or the plants will be drenched at stated intervals with a solution of the hemp leaf. Hing, 'assafœtida,' is more effective, but expensive, as it is a Kábul production.

* * * * * *

"3. Heavy rains wash off and wind-storms whirl their hoary cradles away, but many escape and redevelopment ensues.

"4. Beneficient nature has provided us with Aphidian enemies. One cannot examine a cotton plant without handling a few *Coccinella*, the lady bird beetle, or *Chyrosopus*, the lace wing, whose larva exclusively feeds upon the devastating Aphidian hordes, but the magical fecundity of the Aphis lanigera overbalances the rapacity of the hungry larva, and the laborer must either passively submit to a lost crop or by the sweat of his brow stave off impending ruin."

But MAJOR DWYER, Deputy Commissioner, Gujrát, in a letter, dated 16th November, forwarding the foregoing remarks:—

"I think the theory that the growth of 'sunn' with cotton would prevent the blight, requires more enquiry before it can be accepted as a proved fact, because I happen at the present time to be, and have been the last week, in the midst of the Lubana villages, the inhabitants of which grow 'sunn' largely, for making sacks for their pack bullocks; for one acre of cotton, I find at least five of sunn, either round and about the cotton fields, or contiguous to them, and I have found here and there a few cotton plants growing in a field of 'sunn.' 'Tela' blight is now past and gone, but the Lubana villagers all declare to me that their cotton was almost entirely destroyed by 'tela,' and if what they say is true, I doubt if the growth of 'sunn' would have any effect in preventing the 'tela' blight."

THE INTRODUCTION OF FOREIGN SEED as one of the best methods of developing the cotton resources of India, is urged with great force by DR. ROYLE, in his "Illustrations," which were published in 1839. He there mentions, besides, actual experiments at Allahabad and elsewhere, that in 1832 some imported seed was sown experimently near Delhi. The Royal Botanical Gardens of Saháranpúr have been, however, the centre of experiment; and for several years different varieties of cotton have been cultivated with success, and the acclimatized seeds distributed. In the Punjab, Leia was one of the first fields of experiment, and a sample of the cotton resulting is now preserved in the Lahore Museum. A similar sample of cotton from Gujrát of some years back is also preserved.

It is, however, only quite recently that the distribution of imported seed has been carried out on anything like a large scale. In the year 1863, a supply of cotton seed was announced, and it was bought up largely. Some zemindars at Lahore, would bid in excess of the upset price. The price of the cotton seed was already very high (nearly three times that of native seed), as the cost of carriage had augmented it. It must be confessed, however, that the demand for acclimatized seed is not yet very general. As a rule the people do not like to take the trouble necessary to ensure a good crop, and above all, they do not like to depart from the traditional methods of broadcast sowing, &c., which are less suited to the foreign seed. Some also complain that they cannot clean, and cannot spin the cotton when produced.

Among the various papers which have appeared detailing the results of the experiments in cultivating foreign cotton, there is one which appeared in the *Punjab Gazette*, August 28th, 1861, which deserves notice. As the paper may not be in the hands of every reader, I have made the following extracts from it.

"As cotton is the article of all others, regarding which most solicitude is at present felt, I will first make mention of it. MR. BERKELEY of Delhi has been engaged for two seasons in making a very spirited experiment with American seed, in a plot of five acres of ground, in the Botanical Garden, made over to him for this purpose. Mexican and New Orleans seed were sown the first year, and produced luxuriently, two bales of the produce being sent to Manchester; and in the second year, MR. BERKELEY found the results from the acclimated seed to be equally favorable; 500 rupees worth of the produce has been sold in all; but as the ground had to be newly prepared, and the experiment was on a very small scale, a still greater outlay was incurred, and MR. BERKLEY has been obliged, from various causes, to give up the undertaking.

"MR. HURST, a member of the Calcutta Agricul

tural Society's Committee, who had just returned from Manchester, reported on a sample of the first year's produce, that such cotton is all that can be desired,—the very kind required by the Manchester spinners. The produce of the Mexican seed was perhaps considered in Calcutta on the whole the best, but it was suggested that the New Orleans would probably produce the more remunerative description. Both were valued at from 7*d.* to 7½*d.* per lb.; and Dr. Brown, Secretary to the Agricultural Society of Lahore, to whom I made over a specimen from the Pernambuco, has subjected it to examination under the microscope, and reports that the fibres, which measure from one inch to one and a quarter in length, appear uniform, free from knots and unmixed with dirt or extraneous matter. He considers it similar in quality to African cotton, valued in March 1859, at 7¼*d.* per lb., while ordinary East Indian was priced at 6*d.* Some South Sea Island seed was also sown but did not germinate; likewise some Pernambuco, which though sown too late to yield a crop the first year, is said to have been very vigorous and in full bearing last year, the plants being about 10 feet high.

"Mr. Cope, who created, and is in charge of, the Public Garden at Amritsar, also tried a like experiment last year, in a plot of that garden, with Mexican and New Orleans seed, and he informs me, that while the current price of country cotton with the seed, was 13 seers per rupee (*i. e.*, 13 lbs. per shilling) he was offered in the open market, a rupee for 8 seers (a shilling for 8 lbs.) and if inclined to sell, he believes he could have got that price for 7 seers, the crop produced being at the same time double the usual crop of the country. Nevertheless, he has experienced, on the part of the zemindars, as has Mr. Berkeley, an indifference on the subject which disinclines them to pay for seed, and accordingly he has contented himself with extending his own experiment this year to 4 acres. Mr. Berkeley distributed a large quantity of seed to the zemindars, and sent some also to Roorkee and Dehra. The latter, under European superintendence, throve, while that distributed to natives appears to have been everywhere neglected.

"Government may no doubt do much by improving the communications, specially by water, towards promoting the growth of cotton or other bulky articles of raw produce, suited for the Europe market, and this is being done in all quarters, to the utmost limit that the means at the disposal of Government may permit. Something, too, may no doubt be done, by disseminating knowledge amongst the people, as to the requirements of England in this matter, and it is a gratifying fact, that, owing partly to this cause and partly to the peculiar character of the season which had lead to an unusual breadth of land lying waste, when the first falls of rain occurred, a larger crop has this year been sown in most parts of the Punjab than has before occurred within the memory of man."

The foregoing extract alludes to the experiments of Mr. Berkeley at Delhi, perhaps no experiment has been so fraught with valuable results deduced from it as that has. The remarks of Mr. Berkeley are so important that I give them in *extenso*—he writes—

"The results of my experiments with the different descriptions of cotton which I tried, may be briefly stated thus:—

"Indian cotton, ordinary crop, produced per beegah of 3025 English square yards, 12 maunds of kupás, yielding at from 12 to 14 seers of cleaned cotton per maund, from 3 maunds 24 seers to 4 maunds 8 seers, the cost of gathering having been previously paid out of the cotton. I forget, now whether an eighth or tenth of the quantity picked was the rate. These rates of produce are equivalent to from 5 maunds 30¼ seers, to 6 maunds, 28¾ seers per acre. In maximum crops I have heard, and from my own observations believe, that the out-turn of cleaned cotton frequently is as much as 5 maunds per beegah or 8 maunds per acre.

"The Sea Island cotton, a most beautiful article of a transparent whiteness, with a slightly bluish tinge, affording the finest fibre, though perhaps not the longest staple, I found could not be depended upon. If I remember rightly, the imported seed did not germinate freely; and of the plants which came up, many were blasted by the first season of hot winds, and of those that survived the rains, many more were killed out and out by the frost of the ensuing winter; so that the results were extremely unsatisfactory. The seed of the first generation not succeeding better, I gave up this description altogether.

"The Nankin cotton was altogether a worthless product. The peculiarity about it was its rather deep red color which no bleaching could reduce, the color extending to the very seeds. Its yield did not exceed about 2 maunds per beegah of 3025 yards, and it was otherwise obviously unsuited to the soil and climate.

"The Egyptian cotton also did not promise well, while apparently suited to the soil and climate, and yielding a product somewhat superior; it seemed to possess no advantages over the common indigenous cotton of the country, which might be successfully attained by the improved cultivation of the latter.

The new Orleans cotton was the description, decidedly adapted for this country. The imported seed germinated freely; the yield the very first ga-

thering, that is in the autumn succeeding its sowing, was equal to, if not larger than, that of the indigenous article; the fibre was beautifully fine and smooth, and the staple from an inch to an inch and a half in length. Some staples of what I grew were sent to Manchester by MR. SMITH, and were declared to be barely inferior to the best description of extra fine, imported from the Southern States of America. The seeds of the first, second and third generations showed no perceptible deterioration, while the spring and autumnal gatherings, from the plants raised from the original imported seed, went on increasing yearly in quantity.

"The acre contains 4840 yards. As the natives sow cotton broadcast, I may say 9 plants at the very least might be assigned to each square yard. At this rate the plants should be of fair ordinary health and growth. Let it be assumed that each of these plants would bear at the lowest estimate 10 full and perfectly uninjured capsules, each capsule would give 27 seeds, and half the weight of the 27 seeds in cleaned cotton. The weight of the 27 seeds would be more than the tenth part of the rupee, as may be ascertained any day by weighing 250 healthy seeds taken from the cotton seed selling in the market, which would weigh about a rupee, hence the account for an acre would be thus: 9 plants in one square yard × 10 capsules from each plant × 27 seeds in each capsule = 2430 seeds ÷ 250 seeds weighing 1 rupee = (nearly) 10 rupees or 2 chittacks × 4840 square yards = 15 maunds 5 seers of cotton seeds, the produce of an acre, that is two-thirds of the gross out-turn in kupas, the remaining third, 7 maunds 22½ seers, being the cleaned cotton, the produce of an acre.

"The selection of the soil is by no means a difficulty; all varieties of equally productive soils have appeared to me equally well adapted for cotton. Thus, for instance, wherever sugar-cane, wheat or gram grows luxuriantly, it may be expected that cotton will thrive equally well.

"Out of the tropics the most appropriate season for sowing is from the 15th to the end of April. The sun has then acquired sufficient heat to produce healthy germination and time is gained to admit of the plants attaining a strength and growth qualifying them to resist the frost of the ensuing winter.

"The mode of sowing is the next matter. DR. ROYLE, in a paper on cotton cultivation drawn up in 1834, recommended sowing in lines to facilitate the circulation of air, and according to it, in most experiments which I have seen, the sowings have been in parallel drills from 2 to 3 feet apart, but beyond this there has been little or no attention to the preservation of uniform distances between the plants. For in the drills they have been in some places more or less crowded, and in some more or less apart. The American method, I believe is, and this is one I pursued, to have the field divided into square yards; to dig circular holes at the intersections of the lines forming the squares about a foot in diameter, and 6 or 8 inches deep; to have these holes half filled with rich mould the mould well mixed with the soil below. The holes are then watered to cause the mould to mingle well with the soil, and 15 days or so after the ground is fit for sowing. Six or eight selected healthy seeds are put down in each hole, at equal distances, about 2 inches under the surface. Eight or ten days after the seeds have germinated, two or three of the weakest plants should be pulled up out of each hole, and those remaining should be allowed to grow together for a week or so more, when another removal of the weakest plants from each hole should be made, and so on, till one, the healthiest plant of the lot, is left in each hole.

"After the plants have attained a growth of 10 or 12 inches, too much care cannot be observed in frequent weeding, cleansing the plant of decaying branches, leaves, flowers and capsules; and also in removing all decaying vegetable matter from the ground: care in this latter particular is of the greatest consequence to ensure good quality, as in case dry leaves or grass are allowed to lie about the roots, a peculiar species of insect is bred, which punctures the capsules, and deposits its larvæ inside. The larvæ are hatched into grubs in the capsule, and seriously damage the cotton in more respects than one."

The *price of cotton* has always been more or less subject to variation; but the excitement produced by the demand for cotton, resulting by the stoppage of the American supply during the war in America, caused a rise in price which was really wonderful. Even now the effects of that crisis are felt, and cotton seems to have permanantly attained a new and higher place in the market, the price once raised by the dearth during the war, has never returned absolutely to its original level. This period is too remarkable in the history of cotton to be left without notice.

The LOCAL COMMITTEE OF ROHTAK remark—

"Prior to the great demand for this staple for the home market, the cost of cotton with seed (uncleaned cotton) was from 18 to 22 seers per rupee, and clean cotton from 7 to 9 seers, now the former sells at 5 seers to the rupee, and cleaned cotton at only 1½ seers per rupee."*

The Revenue Report for 1861-62, well describes the results of the excitement in the following paragraph:—

"The return for the present year, 1861, gives an

* Recently the price has been higher than this even.

aggregate of 5,47,414 acres, being an increase upon last year of 66,063 acres, which is much less than might have been expected from the most unprecedented prices which have latterly ruled in the markets; and the great excitement prevailing in regard to it at the Presidency towns more especially. Last year the price of cotton, as shown by the returns then submitted, ranged from 10 to about 12 Rs. per maund. Now the price of fair cotton at Káráchí has, I believe, risen from 25 to 30 rupees, and is expected to reach 35 or 40, if the excitement continue; and whereas at this time last year, the native dealers appeared quite unconscious or indifferent; and I believe the only persons who then thought of exporting largely, were MESSRS. COPE and Co., of Amritsar, now it is said that people are going about from village to village purchasing every seer they can procure, at prices not heretofore thought of. Every effort was made by District Officers, to whom a circular was issued for the purpose early in the sowing season, to rouse the agriculturists to a sense of the importance of the crisis; but it would appear not to have been until advices from Bombay and Káráchí worked conviction on the minds of the trading classes, that it began to be apprehended, too late to have much effect on the sowings of the present season, insomuch that in many districts, it will be seen, the area sown has actually fallen off since last year, owing mainly to the continuousness of the rains when they first set in.

"Still there has been, as above stated, some increase, and it is estimated that 6,02,466 maunds will be produced at the least; if the season prove as favorable as it promises at present to be. Of this quantity District Officers assume that not more than 1¼ lakhs of maunds (ten millions of lbs.) will be available for export, but I feel pretty sure myself that four times this amount will be exported during the current year, if the same high prices continue, and the means of transport be available. Even at the end of May last, after the close of the year, MR. COPE assured me that at least 10,000 maunds had been purchased for export within one week, in the vicinity of Amritsar; and since then further purchases have been constantly going on, showing how much more may be forthcoming on an emergency, than is ordinarily supposed. In the same letter, that gentleman added: 'The export of cotton will add about 3 lakhs to agricultural returns in these parts, and if it continue, the result will be much larger:' an estimate which I am by no means inclined to regard as excessive.

"While, however, there is every reason to believe that imported varieties of cotton will prove greatly superior to the ordinary indigenous varieties, there can be no doubt, that very much might be done to improve the produce of our existing species, and of the crops ordinarily raised by our cultivators, by greater care in picking, by better selection of seed reserved for sowing, and by adopting all such arrangements as are found to render the fibre better adapted to the Europe markets, and now that machinery is being adapted by some of the Manchester spinners to suit it for working up Indian cotton, this has become a matter of greater importance than ever. I understand that the best Indian cotton now sells in England at 6½ pence per ℔., and could some of our European capitalists, connected with the cotton trade be induced, after the example set by the Belfast Association in regard to Flax, to send out agents to this country capable of instructing the people, and authorized to give prices varying with the excellence and cleanness of the cotton produced, two or three years would see a vast change effected. I subjoin three extracts relating to the cotton raised by MR. BERKELEY, which will be read with interest.

"'In last report, I expressed the opinion that the Punjab could not compete, as a cotton producing country, with portions of the Bombay Presidency and of Haidarábád and Nagpúr; which have long been distinguished as supplying the very best descriptions of cotton; and, although I still believe this to be true, supposing the demand to be limited, yet with the enormous demand now existing, it is clearly the interest and the duty of every portion of the Empire, in which cotton is grown, to do its utmost towards swelling the supply; and from what has been said above, it may be assured with certainty that we know as yet but little of the improvements which skill and capital may effect even here. The accompanying return gives the average produce of cotton fibre per acre in the Punjab, at about 88 lbs., but I believe this to be below the mark, in anything like a tolerable year. The Hissar return gives 156 lbs., and MR. COPE informs me that his enquiries lead him to believe that 150 lbs. is a fair average about Amritsar: 180 or 200 lbs. being considered a good crop; and as much as 300 lbs. being gathered in exceptionally favorable years.'"

I shall reserve all further remarks on individual experiments in cotton growing for detail in connections with the specimens in the sequel, by which they are illustrated.

The pressure on the cotton resources of India, during the last few years, no doubt creates a tendency to forming exaggerated notions of the capabilites of a province for the production of this crop, we must be on our guard against hoping too much; that sanguine expectation, while overlooking difficulties and obstacles, grasps at a golden future, too often

results in a disappointment, which leads to an utter despair of success, as false in itself as the unlimited expectation was. Even though the Punjab should never become a country whose staple produce is cotton, yet considering the area under actual cultivation, and the confirmed habit of the people in sowing this crop, every exertion, both to improve what we have and introduce what we have not, is in itself laudable, and sure to be productive of good. I shall conclude this sketch, by another extract from the valuable information contained in the "Gazette" already quoted. It shows well what are the prospects of cotton cultivation, and what difficulties are in the way.

"There cannot well be a shadow of doubt in the minds of those who know India, where cotton is probably indigenous, that it is capable of producing this article of almost any degree of excellence, and to an amount fully sufficient to supply the whole of Europe; and all experiences tends, I think to show, that what is now required is not the instituting of small and insulated experiments, but the deputation to this country, by parties interested, of men of skill and capital, able to direct the people as to the best mode of cultivating and preparing cotton, and ready to purchase on the spot, at remunerative prices, all that may be produced, suited to their purposes.

"While in England I endeavored to urge this on all occasions, but was surprized and discouraged by what appeared to me to be the prevailing want of enterprise, in regard to any new and uncertain undertaking in India; and even in Bombay I was usually told by the merchants, that their business was to purchase cotton when offered, not to look after its production.

"I have no hesitation, however, in stating my conviction, that the Punjab can never compete with other parts of India as a cotton exporting country, notwithstanding its great advantages in the matter of water carriage.

"The basaltic soils of Central and Western India, and perhaps some parts further South, are the parts to which England must look, viz., Gujrát and Berar, primarily, and after them the Nurbudda territory, yielding what is commonly termed, Bhawurgurh cotton; and Bundelkhund, large portions of the very best portions of which will be shortly opened up, and in part have already been opened up by the railroads to Baroda, Nagpoor and Jubbulpoor.

"I was assured many years ago, by MR. TERRY, the most practical and skilled of the Americans formerly employed experimentally by Government, that the plant yielding what is known in the market as Omraoe cotton, and which probably does not differ from that of Gujrát, is a distinct variety from that of other parts of India, having three lobes only in the capsule, while the latter has four, and that he considered that cotton, if well prepared, equal to any American cotton for the great bulk of the manufactures of England.

"Government were at that time about to abandon the experiment, and he assured me, that if any capitalist would take him by the hand, he would undertake to produce cotton to any extent, and of excellent quality for the English market. But Government failing him, no one took him up, and nothing permanent resulted from the costly efforts which Government had made."

The collection consisted of the following kinds:—

1732.—Cotton (ordinary native).

Exhibited without specification of any particular species or origin as to seed or cultivation. When cleaned from the seed is called "ruí" and "pambah;" the separated seed, "banaula;" when uncleaned, "kapás." In Házárá the plant is called "bár."

In the Mazaffargarh district the native name of cotton plants are thus given:—

The plant (Punjabí and Sindhí)—wanwár.

The raw cotton, uncleaned—kapás, phúttí.

The cleaned cotton—kapás and rui.

Seed separate (Punjabí, banaula)—pévé and kachra.

The unopened cotton pod—dódah.

The open pod—gógra.

The Samples were from—

(4715-16) Delhi, cleaned and uncleaned, and a sample in the pod (4718).

In this district it is noted that 5 maunds of cotton with seed, and 65 seers cleaned, is the average yield per acre.

(4721) Gurgaon (Firozpúr).

(4723) Rohtak.

(4729-30) Ambálah (cleaned and uncleaned).

(4735) Ludhiana (AMIR SINGH, Chaudrí).

(4737) Bhaji of Simla.

(4739-40) Mahlog of ditto (cleaned and uncleaned).

(4742) Sirmúr of ditto.

(4746) Balsán of ditto.

(4815-16) Sealkot (Bhadáwala), cleaned and uncleaned. Value, 20 and 28 rupees per maund. MUHAMAD KHAN.

(4878-82) Lahore Museum series. Cotton from Jhang, Leia and Lahore.

(4892) Gujranwalla.

(4899) Rawalpindi, and the seed (4900).

(4902) Gújrat.

(4916) Jhilam.

(4922) Shahpúr (Khusáb).

(4935) Gugaíra.

(4950) Dera Ismail Khán.

(4951-60) Dera Ghází Khán (a series).

Cotton from all parts of the district at prices varying from 1 seer 12 chitaks per rupee to 2 chitaks, from Dera Ghází Khán, Dájal, Chotí, Rájanpúr, and Sangar.

(4965) Peshawur.

(4971) Kapúrthalla.

(4975-76) Kashmír (Srínagar), (two samples).

(4980) Farídkot.

(4981) Nabha.

(4984-85) Pattiala (cleaned and uncleaned).

(4989) Malerkotla.

(4970) Hazara (Manserah), (cleaned and uncleaned.

(4780) Kangra (Haripúr).

(4791) Kúlú.

(4793-97) Hushyarpúr (two samples of cleaned and uncleaned).

1733.—Cotton grown from imported American seed (New Orleans).

(4717) Delhi.

(4719) is a sample of the same in pod. Lalla Chunna Mal.

(4725) Rohtak. Lieut.-Col. Voyle.

(4762) Jálandhar, grown by Zemindars. A note from the district gives the produce of cotton with the seed on irrigated land at 15 maunds per acre.

(4763) Jálandhar, grown for Government. Deputy Commissioner.

1734.—Sealkot series.

(4811) American cotton, uncleaned. Value, Rs. 25 a maund. Jaswant Singh.

(4813) American cotton, cleaned. Budh Singh.

1735.—Lahore series (Lahore Museum).

(4879) Cotton grown from American seed at Dera Ghází Khán.

(4880) Ditto Gujrát.

(4883) Ditto at Kasúr tahsil, Lahore district (1863).

(4884) Ditto, first quality at Sanda, near Lahore. Chaudri Imam Baksh (1863).

(4893) American cotton. Gujranwalla.

(4904) American cotton. Gujrát.

(4923) American cotton. Shahpúr. Dr. Henderson.

(4946) American cotton. Government garden, Muzaffargarh. W. M. Coldstream, Esq.

With reference to the Shahpúr sample, I append a communication by the exhibitor, showing the very remarkable fact that American cotton has been known for years in Shahpúr.

"I am just sending to the Society 20 seers of green-seeded New Orleans cotton, acclimatised at Shahpúr for one year; also 20 seers of white-seeded Mexican which has been grown here for about eight years, and which last year yielded at the rate of eight maunds of seed cotton per beegah when sown in rows 4 feet apart. I also send 20 seers of green-seeded New Orleans cotton, which has been grown for at least 50 years in this district, I can get no information as to when or by whom it was introduced, the Lumberdars say it was grown by their grandfathers before them. I do not think it has degenerated perceptibly. I send a few seers also of acclimatised Egyptian seed. This cotton yields pods all the cold weather, but only in very small quantity at a time. I find that the total yield is rather more than New Orleans, but the Zemindars here allow cattle to destroy it as soon as the season for collecting country cotton is over.

"We have two kinds of hybrid cotton, a few seeds of which I can spare if any one takes an interest in it. Next year I hope to have several maunds of it and of several varieties. Should you want any more cotton seeds I shall be happy to send to any applicants all I have over. I have tried exotic cotton in various ways, and I find that the best way of sowing it, is to make trenches 1 foot wide by 6 inches deep at 4 feet 6 inches apart, put a good quantity of manure in these trenches and sow the seeds four together, at intervals of 3 feet. I have tried rows 8 feet apart, and as near as 3 feet. Even at 8 feet the rows of plants touch, and at 3 feet they form a perfect thicket. I think that between 5 and 6 feet will give the largest yield of cotton per beegah. By sowing in trenches there is a very great saving of water for irrigation. As the foreign cotton lasts for several years, I have tried planting young sheshums along the rows; these will get water for one or two seasons, and when the field has ceased to yield cotton there will be a fine young plantation left. In this way I think good timber might be raised in very large quantity at very little cost where there is much waste land suitable for cotton cultivation, each field being given up to the trees after three years, and new ground brought under cultivation.

1736.—Cotton from acclimatised American seed.

Samples from—

(4720) Delhi. Lalla Channa Mall.

(4905) Gujrát.

(4917) Jhilam. Pind Dadan Khán. From Agri-Horticultural Society's seed.

1737.—Egyptian cotton.

The peculiarlity of this cotton is, that in many loca-

lities it grows luxuriantly but never produces a flower or a boll of cotton: in the Agri-Hort. Society's Gardens, at Lahore, the seed plants, or rather trees, of Egyptian cotton, which have never borne a flower yet, are nearly 20 feet high, and the stem thick in proportion.

(4812) Sealkot, and (4810) uncleaned. Value, Rs. 25 a maund. MR. J. WIGHTMAN.

(4814) Sealkot. Value, Rs. 33 a maund. BUDH SINGH.

(4903) Gujrát.

1738.—[4726]. Nankin cotton. Rohtak. LIEUT.-COL. VOYLE.

* This is a cotton having naturally a yellowish red or tawny tint: it is very little grown in the Punjab.

1739.—[4925]. Mexican cotton. Shahpúr. DR. HENDERSON.

The lengths of staple and values of Punjabí cotton are thus given in the table prepared by the Jury for Cotton in the International Exhibition of 1862. The samples were those produced by the Central Committee at Lahore.*

District.	Length of Staple in part of an inch: Maximum.	Minimum.	Mean.		Value per lb.	Remarks.
	Decimal fractions.			In vulgar fractions.		
Jhang district, 1st quality,..	·95	·65	·80	4-5ths	6½ to 8	Strong, short, and clean.
Jhang district, 2nd quality,	·80	·50	·65	2-3rds	6¾ to 9	Strong, short, and clean.
Ambálah, ...	·90	·70	·80	4-5ths	8	Chopped to bits in ginning.
Hushyarpúr, ...	1·00	·70	·85	7-8ths	7½ to 9	Shell; short; strong; badly ginned.
Multán, ...	·90	·60	·75	3-4ths	8	Very weak, but of good color
Leia, ...	·90	·70	·80	4-5ths	8 to 8¼	White; clean.
Messrs. Smith, Fleming and Co., Punjab cotton, ..	1·20	·90	1·05	1	8 to 8¾	Very weak, but of good color.

As a sort of appendix to this class, I extract the following:—

Memo. on cultivation of acclimatised exotic cotton at Bakkar, in the Dera Ismail Khán district, which is curious from the locality, and interesting from the accuracy and completeness of the observation of results attained.†

"About the middle of April 1864, I received a small supply of acclimatised Egyptian and Mexican cotton seed, from the Secretary to the Punjab Agri-Horticultural Society, and at the same time I received from DR. HENDERSON of Shahpúr, a packet of acclimatised cotton seed of the following kinds, viz.:—

"1. Egyptian; 2, Nankin (dust colored seed); 3, New Orleans (black seed); 4; New Orleans (green seed); 5, Mexican (white seed); and Sea Island.

"I divided each kind into two portions—one portion I had sown in the Government garden (Dilkhushá) in the 'kachí,' and the other portion in the land attached to the kutcherry in the 'thal.'

"The seed was sown, in accordance with directions I received from DR. HENDERSON, viz., in trenches 1½ feet wide, 9 inches deep, and 5 feet apart. The trenches were filled up to within 2 or 3 inches of the surface with good manure, which was well dug in; 6 or 8 seeds were then sown, at intervals of 2 feet. The seed was all sown by the 26th or 27th of April.

"I mentioned above, that one portion of the seed was sown in the Dilkhushá garden in the 'kachí,' and the other portion in land in the 'thal.'

* DR. JAMESON contributed the following samples of cotton from acclimatised seed grown for ten years in the Botanical Gardens at Saharunpúr.

1. New Orleans cotton.
2. Upland Georgian ditto.
3, 4. The same, with their seeds.
5. Yellow Shanghai or Nankin cotton.
6. Egyptian cotton.
7, 8. The same with their seeds.

† The memo is BY LIEUT. HARE, Assistant Commissioner.

The 'Dilkhushá' is a large garden made by the grandfather of the present Nawab of Dera. It is surrounded by a bund built to keep out the inundation, which sweeps over the 'kachí' in July and August; on either side of this bund are rows of splendid shisham trees, and numerous date trees. There are also numbers of shisham trees inside the garden, consequently the cotton plants did not get as much light and air as they required.

The soil is good, and the situation being low, there is always a good deal of moisture in it. During the inundation, the percolation of water is great, and the growth of all plants is rapid.

"The kutcherry at Bakkar, is built on the sandy upland, known as the 'thal' The land surrounding the house, was brought under cultivation some 8 years ago, by the Nawab, who sank a well in it, but owing to the poverty of the man who was in possession from the commencement of British rule until 1863, when the estate was purchased by Government, only a small portion of the original estate had been cultivated for some years past.

"Some of the seed had therefore to be sown in land, that had lain waste for many years.

"As the soil of the 'thal' consists almost entirely of sand, no crops can be raised without well irrigation and heavy manuring; by adopting Dr. Henderson's plan of sowing th cotton in trenches, there was a great saving of manure and water.

"The plants grew very rapidly in the Dilkhushá, especially during the inundation, their growth was somewhat checked, by continually breaking off the top shoots.

"The growth was not so rapid in the 'thal,' but I was advised by natives, to adopt the plan of breaking off the top shoots, and I observed, that where this was done, the plants yielded much finer pods, although the number was somewhat diminished.

"With the exception of a few plants which were attacked by the 'telí' blight, the plants in the garden in the 'kachí' were perfectly healthy.

"In the 'thal' the plants were extremely healthy, and of those grown in soil that had lately been under cultivation, I did not lose one; but in the land brought under cultivation for the first time, for some years, several plants were killed, by the scorching wind and drifting sand. I had not sufficient bullocks to work the well; and directly a plant was injured by the wind, it was eaten by white ants, which abound here. I eventually adopted the plan of putting up a screen of date branches to protect the plants from the burning wind.

"The plants commenced flowering in August. I was absent from Bakkar during September; but on my return at the commencement of October, I found the plants a mass of pods and flowers, many of the plants were so laden with pods, that they were completely weighed down. I counted 241 flowers and pods on one plant (New Orleans) growing in the 'thal,' and 221 on another plant of the same kind growing in the 'kachi.'

"I measured the size of the pods of each description of cotton, and counted the number of pods on several plants. When the pods ripened, I picked and weighed several of each kind of cotton.

"The picking commenced about the middle of October, and continued up to the middle of January. The cotton of each description was picked separately and put in large sacks made of matting, under the superintendence of a munshi.

"At each picking 3 or 4 pods were set aside and weighed by the native doctor, who kept a register. I was unable to weigh them myself, after the first time, as I had to go into camp, but I think the weighing was carefully done.

"I append a statement showing the height of the plants, weight of cotton, &c., but I must here explain that columns 7 and 8 do not give the average weight of the pods on any particular tree, but merely the average weight of each kind of cotton, throughout the pickings, from October to December. It will be seen that the acclimatised cotton pods yielded upwards of $\frac{1}{3}$ wool, and $\frac{2}{3}$ seed, whereas country cotton only yields $\frac{1}{4}$ wool to $\frac{3}{4}$ seed, the pods of the latter being about $\frac{1}{3}$ the size of the former.

"It will be seen from the statement that the Mexican cotton succeeded best, both in the 'kachi,' and in the 'thal.' The pods of this plant were remarkably fine.

"The green seed New Orleans cotton ranks next, for, although the average weight of cotton in each boll of this description, 16 grains, while the New Zealand yielded $17\frac{1}{2}$ grains, it will be seen that the number of pods on the former, was from 45 to 50, whereas the latter only had 40.

"Black seeded New Orleans comes next on the list and then Nankin. These two descriptions, together with the New Zealand cotton, were, owing to the want of space, planted in a part of the garden, very much shaded by trees, and the plants in consequence shot up, and spread so rapidly that they did not get sufficient air and there was so much wood and leaf that the plants did not yield as much cotton as they would have done in a better situation.

"I consider the Egyptian cotton was a failure, the pods were few in number, and small, and did not begin to ripen till near the end of October; the yield was very small, as the cold weather came on before the pods were ripe, the result might have been more successful if the seed had been sown earlier, but the

tendency of this kind of cotton plant is to run to wood and leaves.

"I consider that the Mexican, and green seeded New Orleans cotton, are best adapted to this part of the country. These plants had a greater number and finer pods, than any other kind. The cotton appeared very good, and the fibre long.

Where grown.	Description of cotton.	Description of soil grown in.	Average height of plant.	Average size of pod before bursting.	Average number of pods on each plant.	Average weight of cotton wool in each pot.	Average weight of seed.	Weight of cotton in largest pod.	REMARKS.
In the Dilkhushá garden in the kachí.	1. Egyptian.	Rather poor, situation airy.	8 to 9	$3\frac{1}{5}$ in. circumference,	18	$3\frac{1}{4}$ grains	34	18	The pods of this ripen later than the other description; and the yield of cotton is very small.
	2. Nankin dust colored seed.	Good, but too much shaded.	5	$4\frac{3}{10}$	20	$14\frac{3}{5}$	$34\frac{1}{2}$	21	The cotton of this plant appears very good.
	3. New Orleans black seed.	Same as No. 2.	5	$3\frac{9}{10}$	25	$15\frac{1}{4}$	$35\frac{3}{8}$	21	..
	4. New Orleans green seed.	Soil inferior to No. 3, but situation better as regards light and air.	4	$4\frac{1}{10}$	45 to 60	16	40	21	220 pods and flowers were counted on one plant, one pod $4\frac{1}{10}$ inches in circumference.
	5. Mexican white seed.	Exactly same as No. 4.	4	$4\frac{1}{3}$	45 to 55	$18\frac{2}{5}$	$44\frac{1}{10}$	23	Some of the bolls of this description were very large.
	6. New Zealand.	Rich soil near well, but much too shaded.	6	$4\frac{1}{10}$	40	$17\frac{1}{2}$	$36\frac{7}{8}$	21	This cotton appears exceedingly fine.
In kutchery compound in the thal.	1. Egyptian.	Very sandy,	6	..	20	$12\frac{1}{3}$	$33\frac{3}{4}$	18	..
	2. Nankin dust colored seed.	"	$3\frac{1}{2}$ to 4	..	..	$14\frac{3}{4}$	$36\frac{1}{8}$	18	..
	3. New Orleans black seed.	"	"	..	..	$15\frac{1}{4}$	$35\frac{3}{8}$	21	..
	4. New Orleans green seed.	"	"	..	..	$15\frac{10}{11}$	$39\frac{10}{11}$	21	241 pods and flowers were counted on one plant.
	5. Mexican white seed,	"	"	..	..	$18\frac{2}{5}$	$44\frac{1}{10}$	22	...
	6. New Zealand.	"	$3\frac{1}{2}$	..	..	$17\frac{1}{2}$	$36\frac{3}{7}$	21	Very few plants of this kind survived.*

1740.—[ ]. Flax *(Linum usitatissimum). Vern.*—Alsi; katán (Arabic); keún (Kashmírí): tisí.

It would be rash to assert that flax is indigenous to India, though there can be but little doubt that its origin is Oriental. It is mentioned in the Scripture, both in Exodus and in Joshua; in the former

* I did not measure the size of the pods, nor count their number in the thal.

book it is described as one of the crops, in the account of the plague of hail. There are very ancient paintings too in Egypt, in which flax figures; and lastly, linen cloth was the material used for burying cloths.

In India, however, the flax has been usually cultivated for its seed, and not for the fibre; the prevalence of cotton as the staple fabric may account for this.

"The Indian plant," writes DR. ROYLE,* "called *alsi* and *tesi*, may be considered a variety which has acquired certain characters from the peculiarities of soil, of climate, and of long and peculiar culture. It is always short, probably not more than 18 inches in height, much branched, loaded with bolls, which are filled with large ovoid plump seed. That this retains its character even in other situations appears from a fact, of which I have been informed by MR. MACADAM, the able Secretary of the Society for the Promotion of the growth of Flax in Ireland. The Society having imported some seed for experiment from India, found that the plant did not grow beyond fourteen or eighteen inches. But that it is also ready to change its habitat is evident from the results of experiments in India. I have also been informed that in a recent experiment made by MR. BURN, in Sindh, with thick sowing and irrigation, it grew at once to upwards of two feet; I have no doubt that with a repetition of the process of thick sowing for a few times the Indian seed would produce plants with tall, straight, and little branched stems, each with but comparatively few bolls and seeds."

It is impossible in a sketch like this to delineate the progress of flax in India: suffice it to say, that in 1839 a company was established to promote the growth of flax in India, and MR. DENEEF, a Belgian farmer, came out, prizes were offered, and every encouragement shown. Some of the flax produced, was valued at £66 a ton; some at £30 and £45.

The experiments were made at Shahábád, Bardwán and Monghyr, and best of these at Sahápanpúr and Jubulpúr. The experiments, however, were mostly on a small scale, and the success on the whole was not brilliant; the Bengal fibres were not at all equal to European.

When the subject of flax cultivation in the Punjab was started, it was observed, that at Lahore and a few other places, some use of the fibre was made for rope and twine, in making charpoys or bedsteads; and still more so in northern parts, as some of the seed of flax obtained in Bukhára proved to be when seen in England, the common flax.†

* ROYLE'S Fibrous Plants, page 143.

† "Fibrous Plants," 193.

In most places the fibre was always burnt, the crop being grown from seed, 3 maunds of which to a begah of land was thought a good crop. The seed sold for from 18 to 30 seers per rupee, and in Kangra up to 100 seers per rupee!

The crop was often cultivated round the edges of fields, or mixed with other crops; it was seldom irrigated, though often planted in inundated khádir lands. In 1853, the Agri-Horticultural Society began their experiments with seed from Sahárapúr: and even at that early stage, the produce of the fibre far exceeded that of previous trials in Bengal and Behar. Then followed proposed prizes for flax cultivation—equitable terms on which flax crops of cultivators would be bought up; and in fact a general system was started by the Society, and warmly seconded by Government, such as was best calculated to introduce the cultivation of flax as a fibre, into the Punjab. The Society's plans are given in detail at page 195 of DR. ROYLE'S "Fibrous Plants." Excellent instructions were printed and circulated by the Society in 1854, copies of which are still to be had.

In short, there seemed no question that flax would succeed better in the Punjab than in Bengal. The native flax at Indaura (Kangra valley) was noted already as valuable. In 1858, a quantity of it was sent home; it was considered to be the finest specimen sent from the Punjab, and was valued at the high price of £55 to £60 a ton, and actually sold at £54 10s.! "If," wrote MESSRS KAIN AND CO., Dundee, "flax such as COL. BURNETT sent home could be put on board at Káráchí for £26 a ton, it would leave to both importer and exporter a handsome profit."

The first question to be disposed of was the fact that the native seed, grown as it was by native farmers, could not yield fibre: was it possible to improve the native seed by better cultivation; or was it best to import seed? Practice up to the present moment has decided in favor of the latter; no doubt, the native flax is capable of improvement, but the ease of obtaining first rate seed from Europe which acclimatizes and lasts without renewing several years, has practically decided in favor of importation. It is interesting to remark how this was at once suggested by the Secretary to the Royal Flax Society of Ireland, in his letter published by the Agri.-Hort. Society in 1854, from which I quote. MR. MACADAM wrote—

"The quality of flax fibre produced in warm climates is necessarily very coarse, and does not, in the least, interfere with what is grown in Ireland, while it is very largely employed by manufacturer's for a certain class of fabrics. It would be much more satisfactory to obtain it from a British colony, than to be dependent, as hitherto, chiefly on Russia for the supply,

"In consequence, not merely of the war, but of the demand of coarse flax having of late years exceeded the supply, manufacturers, both here and at Dundee, are very anxious to obtain flax from India. The Belfast and Dundee Chambers of Commerce have forwarded memorials to Government on the subject, and I have had some correspondence with DR. J FORBES ROYLE, of the India House, on the subject. He appears to think that very little fibre can be obtained from the flax plant of India, which he states to grow very short, and to have extremely little fibrous matter round the stem; but I have all along thought, that if a fair quality of coarse fibre can be produced in the valley of the Nile, the export from Egypt being 3,000 to 4,000 tons annually, there is quite as good a chance in the valley of the Indus; and I had already pointed out to DR. ROYLE, the Punjab, as one of the best points for making the experiment.

"I am inclined to think that one cause of Indian flax being reported on so badly is, that the proper kind of seed is not employed, and I would strongly recommend that Riga seed should be procured here for future trials, as the natives have hitherto employed only the seed of the country, which has quite a different character from the Riga."

Of late years the Belfast Indian Flax Company have, by their agency at Sealkot, completely established the ascendancy of imported and acclimatised seed, and though there have been failures on account of the deterioration of batches of seed during its transport from Europe, the experiment has been successful. We must not be surprised at losses, perhaps heavy losses and disappointments at starting: hardly any great enterprise that has now made the fortunes of hundreds has ever come into existence or completed its growth without many reverses; nor must we expect this to succeed all at once without a shadow of disappointment passing over.

The operations of the Society at Sealkot have already been viewed with the warmest interest by Government, who have rewarded by prizes and khilats the successful cultivation by zemindars, in a manner which we can only wish to see extended to other departments of agriculture.

The advances made at Sealkot, year by year, are on record, and present some of the most interesting and economically valuable records it would be possible to collect.

To show how satisfactory the foundations of the undertaking was when the worst calamity, the failure of its seed happened, I extract paragraph 129 of the Revenue Report for 1861-62.

"The sanguine hopes expressed in my last report, in regard to the operations of the Belfast Indian Flax Association at Sealkot, were shortly afterwards seriously damped by the discovery, that the whole of the seed sent out by that body, had been so entirely damaged on the way, that no portion of it would germinate: an announcement which produced so depressing an effect, both on their agent here, and on the Committee at home, that it at one time appeared doubtful if they would have the resolution to persevere in the undertaking. On the spirited representation, however, of DR. FORBES WATSON of the India office, who had very opportunely received a specimen of last year's Sealkot flax, valued by the Committee themselves at between 60 and £70 per ton, the Right Honorable the Secretary of State for India was pleased to authorize an advance to the Association of £1,000 per annum for 2 years; on their engaging to carry on their operations for 3 years at all events; which most liberal offer was thankfully accepted, and the progress of the undertaking at once ensured.

"Very great disappointment was evinced not only by the agent, MR. WIGHTMAN, but by the zemindars themselves, on finding that the seed which they had confidently anticipated would be distributed to them in September, had utterly failed.

"All the available acclimatised seed of the previous season was however distributed—the zemindars contending with each other for shares—and the season having proved favorable, the results have been most encouraging, as shown in the subjoined extracts* from a letter of the Deputy Commissioner of Sealkot, dated 24th April last. MR. WIGHTMAN, was fortunately at Káráchi when the flax of the season, manufactured and dispatched by him, arrived there, so that he was able himself to see it pressed and shipped, so that I am in hopes the results of the season, though

* With regard to the prospects of this season, MR. WIGHTMAN'S report is most promising. 200 maunds of flax and 150 of seed, all English, have already been taken in, which exceeds the out-turn of the whole of last year's crop. The English flax is much superior in quality to anything produced last year; and, indeed to anything MR. WIGHTMAN thought possible to produce here. But the native flax is very inferior to last year, and little of it will be fit for export.

The price given for three maunds of straw is Rs. 3, and one maund of seed Rs. 5. The seed advanced being first deducted in kind. The market price of native seed is about Rs. 1-4 per maund. The value of the product of an acre in such villages as Doobarjee has been from 42 to 45; the average of an acre of wheat even at present high prices is from 25 to 30. In ordinary years the difference will be still more striking, several growers and those not first rate ones, have informed the Deputy Commissioner that even at present prices, flax is more profitable than wheat.

"MR. WIGHTMAN states that his prices are such as pay him.

"Under these circumstances I think the prospects of the movement may be considered most cheering."

small, may prove very encouraging to the Committee at home.

"Recently a very large supply of Riga seed (I believe 15 or 20 tons) sent out by the Association was received by steamer at Bombay. Their agent, MR. WIGHTMAN had proceeded thither from Sealkot to receive it, and the most energetic action was taken by His Excellency SIR BARTLE FRERE, Governor of Bombay, for securing its immediate transfer on reaching the harbour to the Kárâchi steamer.

"It accordingly reached Kárâchi without delay, was there examined and found to be in good order, reached Múltán sometime ago by steamer, and is now on its way laden on camels to Sealkot. Another ton of seed, ordered on account of Government, has also reached Calcutta, and may be expected here shortly; when it is proposed to distribute it to cultivators willing to cultivate, in the Lahore, Gujranwalla and Amritsar districts, so that the spirited undertaking of the Belfast Association could hardly give better promise of success than it does at the present time. A distribution of prizes for the cultivation of flax has been authorized to take place during the present month, and I have no doubt that under the auspices of MR. PRINSEP, who has from the first taken a hearty interest in the experiment, it will have the best effect."

The more recent statistics of the Company's operations at Sealkot appear in the following extract:—

"The prospects of the Company may be briefly stated as follows:—

"Last year, 1861-62, 80 maunds of prepared flax were sent home. The quality is supposed by MR. WIGHTMAN to be equal to any grown in Ireland.

"In the present year, 1862-63, 200 acres were successfully cultivated, of which the out-turn (not including seed given and its equivalent received) was as follows:—

	Mds.	Price paid.
"Flax straw, ... Rs.	2,533	844
Seed, the produce of acclimatised seed, ... Rs.	490	1,960
Ditto, imported ditto, „	234	1,404
Total, „	3,257	4,208

giving an average of Rs. 22 per acre. Rs. 40 would have been the average, had the seed been good. The average yield of wheat per acre has been about Rs. 18.

"The quantity is the same as the previous year, as regards produce of acclimatised seed. The produce of the imported seed is superior to that of acclimatized. The out-turn will probably be 8 tons = 216 maunds. Only 30 maunds of native straw have been taken out good, as native straw is only two feet long, and English three and more; and the labor required for a bundle of the same thickness being the same, there is of course, a loss in labor of one-third, the straw is also more woody.

"In 1863, 291 acres were under flax cultivation in Sealkot, and its yield was 34½ tons of seed, and 178 tons of fibre."

The whole process of flax cultivation has been so fully described, that it seems superfluous to make any allusion to it. The main points requiring attention appear to be not to sow too late, as otherwise the growth instead of being progressive, steady and slow, such as insures a tall even firm plant, becomes by the heat of the later season, &c., rapid and hectic, and the value of the fibre is destroyed both as to length and quality.

The other point requiring attention is to gather the plant at the right time, the simplest method of judging being by observing the leaves falling off from the stalk; when the leaves have fallen off, up to a certain height, the stalk is ready, and this at a time when the seed also is not so ripe as to be shaken out of the pods.

The seed is generally now removed, by the process of rippling, done on or near the field, which simply consists in drawing the heads of a handful of the plant spread out like a fan, lightly over the pointed teeth of a large iron comb fixed upright, and teeth upwards, into a stout wooden beam. The fibre is then stacked in bundles, and then steeped. In some parts of Russia, the flax is dew-retted by exposure simply on the surface of the soil to dew and rain. When the watering process is done, the flax is very carefully lifted out, and spread on the soil for a certain time. The flax is lifted out of the water by men's hands and not by forks, which destroy the fibre. The length of time required for steeping is very various, according to circumstances. It is said to be a good method of testing the completion of the process, to take out a stalk of average thickness and break the *shove* or woody part at the centre in two places, 6 or 8 inches apart: if this detached piece of wood can now be drawn easily out downwards without hurting the fibre, and without any of the fibre adhering to it, the steeping has gone on long enough.

When sufficiently dry after SPREADING, the flax is LIFTED, and bound into small bundles. It should never be dried by fire, for this spoils the fibre and renders it weak and brittle. Improvements in steeping have been the subject of much enquiry. The idea of heating the water for steeping, occurred to some, and the application of steam to others. SCHENCK'S process and WATT'S process, which are embodiments of two principles, are the best known; both are treated of in detail in ROYLE'S Fibrous Plants.

The next thing to be done is to remove the woody bark, &c., from the fibre, called breaking. This

used to be done by hand, by twisting up a handle of stalks as it passed through the hands, and then shaking off the bark fragments that were separated. The same was also effected by the *bott hammer*, a flat mallet, with its face cut into grooves, the handle to it being curved, and this being repeatedly struck on a quantity of fibre spread out on a board, first on one side and then on the other. But as the whole of the bark is never removed by this process, another is required, viz., *scutching*. An upright board has a horizontal slit in it, the slit being made at the edge of the board and narrow at the end: into this slit a handful of broken flax is inserted, and the right hand strikes the fibre in the slit, with a kind of wooden sword or trowel, 8 or ten inches broad: the flax is continually shifted about in the slit by the action of the left hand. The operation also used to be performed by passing the flax between 3 fluted metal cylinders, one of which is made to revolve, and carries the other two with it.

Since this time many improvements have been made in machinery. Fluted conical cylinders, whose distances from one another could be variously adjusted, were employed. Several manufacturers have now devised machines whereby the previous process of retting may be dispensed with.

The last process in preparing the fibre is that of smoothing, separating and arranging the fibres, by the process called *heckling*. This is effected by skilful manipulation over the points of a kind of comb.

The refuse is "tow" and this yields a packing material, but is still more valuable as being a very superior paper fibre.

The sample exhibited under the head of flax were as follows:—

1741. [4770]. **Flax from Núrpúr, Kangra district.**

Grown by the zemindars in pergunah Núrpúr for fibre as well as for seed, and largely exported into the Punjab.*

1742. [4799-4809]. **Series illustrating the flax cultivation of the Belfast Company, under their agent, Mr. Wightman, at Sealkot.**

Flax produced from imported seed. Ditto from seed acclimatised (the 2nd year). Ditto (3rd year). Value, 2 maunds per rupee.

Flax after steeping. Value, 1 maund per rupee.

Native ditto. Value, 3 maunds per rupee.

Flax (dark colored) scutched, &c. Flax (white) prepared differently. Value, from £50 to £100 per ton.

Tow. (The refuse from the heckling and scutching, useful for paper making). Value, 2 rupees per maund.

Seed, resulting from the 1st growing of imported seed.

Ditto, 2nd growing of. Value, 5 rupees per maund.

These seeds are larger and longer than native seeds; and have a greenish brown tone, instead of the red-brown or reddish tone of the native.

1743. [4830-35]. **Lahore Museum series.**

Indaura flax (Kangra district).

Flax grown at Lahore in the Agri-Horticultural Society's Garden.

Flax grown at village Sanda, near Lahore. Chaudri Imam Bakhsh.

1744. [4894]. **Flax, Gujranwalla.** Local Committee.

1745.—[ ]. **Madár floss, the cotton of the pods of *Calotropis hamiltonii*.**

This plant grows everywhere on waste dry situations where nothing else will grow. It flourishes actually on beds of simple sand, and it appears to require no water. Its broad leaves, its white and purple incised bell-shaped flower, may be seen all over India, though the prevalent species southward is *C. gigantea*, and that in Northern India is *C. hamiltonii* or *C. procera* still further north and up to Persia. Notwithstanding the barrenness of lands where it is usually found, it does not appear that richness of soil and fertility are prejudicial, and we hear of plants in Demarara, to the height of 12 or 18 feet, and in Mysore to a great size.*

The floss of the madár is found within the large crescent-shaped seed vessels, as soon as they are ripe; but the stalk of the madár plant itself affords a tough coarse fibre which makes ropes of surprising strength. In the Bombay Selections, No. XVII., it is mentioned that fishermen in Sindh use the fibre for ropes to their nets.

The floss of the Syrian dogbane, one of the *Asclepiadeæ*, has been made into fabrics both in France and Russia. And the jeté or bowstring fibre of the Rajmahal hills (which bore 248 lbs. when dry, and 343 lbs. when wetted, when hemp bore only 158 and 190 lbs.) is also produced by *Marsdenia tenacissima* of this family.

* Local Committee, Kangra.

* Madras Exhibition of 1859. Notes on Calotropis fibre and Silk, page 4.

The juice is used in tanning leather, and coagulated forms a white kind of gutta percha. A sample was contributed to the Exhibition of 1864 by DOCTOR HUNTER from Madras. Ten average plants will yield enough juice to make 1 lb. of gutta percha. The juice is evaporated in a shallow dish, and when dry is worked up in hot water with a wooden kneader, as this process removes the acridity of the gum. It becomes soft in hot water, but is hard certainly in cold. The sample sent to the Exhibition in the winter was quite hard, having received the impression of a medal some time previous in Madras. It is soluble in turpentine.* No attempt has I believe been made to produce it in the Punjab. The roots are burnt, and the ashes of them extracted for a medicine for asthma, esteemed by native doctors.

The root and the bark of it powdered, as also the juice, are powerful alteratives, and are used in leprosy and other cutaneous disorders, and in elephantiasis.

The madár is also famous for yielding the "shakar-ul-ashar," or "Shakar taghár," a kind of manna.† The insect by whose piercing the exudation is formed, is called *gultigál* ‡. This is very uncommon, however, and cannot be obtained in the bazars.

The madár is remarkable for containing a principle called *Mudarine*, which coagulates on being heated, but again liquifies when cold.†

Unlike other fibres, the madár needs no preparation, the silky yellowish floss has only to be collected free from dirt and packed. Experiments have been made with it by MESSRS. THRESHER and GLENNY, not however without great difficulty, on account of there being no machinery suited to it; the cotton machinery literally blew it away. This enterprizing firm, however, produced some articles of clothing, and some other articles, with madár and common cotton in equal parts, and a flannel from madár in one part, and wool two parts.

The great difficulty seems to be the price. In the Punjab, the collection was taken up with some interest in the district of Dera Ismail Khán; but it appears that the cost of carriage and collection is such that the floss is at present unremunerative at the selling price. The principal objection to it is the weakness of the fibre. It will probably in any case succeed better as a mixture. The Exhibition of 1864 contained fabrics from Dera Ismaíl Khán and Rawalpindi woven from madár, and also rugs made in the "turkey carpet," or pile fashion.

Floss or silk-cotton from the pods of the madár, was sent from—

(4836) Lahore (village Sanda).

Sample of twisted thread from ditto (Dera Ismaíl Khán produce), (4837).

(4898) Rawalpindi.

(4221) Shahpúr (thal tracts).

(4945) Jhang.

(4949) Dera Ismaíl Khán.

(4991) Maler Kotla.

There is a paper on the manufacture of cloth and paper from this substance in Vol. VII. of the Agri-Hort. Society of India's Journal.

1746.—[ ]. Fibre from the stalk of the madár.

A sample of the rope from the stem fibres of the madár was also sent from Lahore, by CHAUDRI IMAM BAKSH (4859).

This is a distinct substance from the former, and is much superior, being very strong, flexible, and yet lustrous and silk-like. It is obtained by cutting down the largest branches in October and November, or April or May: just when the plant ripens, or when it is growing to flower, is the best time. Steeping in water cannot be practised, as it damages the fibre: but the branches on being cut are allowed to lie awhile, and then are beaten and bruised all over, especially at the joints; and the bark *with* the fibre is peeled off: the fibre is picked off the inside of the bark *not* from the stem itself.

"The workmen," says CAPTAIN HOLLINGS, "bite though the centre of the bark, then hold the tissue of threads with one hand and separate the bark with the other." CAPTAIN HOLLINGS says, "the manufacture costs £100 a ton, and making thread of it £120, the expense being in separating the fibre, for which some improved process is much needed. Cordage and rope have been made of it, but with varied results as to strength. The Indus fishermen make lines for their nets with the fibre." Many more particulars as well as the methods of manufacture will be found in the 2nd Vol. of the work, under "Fibrous Manufactures:" and several papers of interest are to be found in the Agri-Hort. Soc. Journal, Vol. VIII., together with the opinions of skilled persons on the fibre.

As a textile fibre it was supposed to be well suited for finer fabrics; as a rope fibre it is found superior to hemp. DR. ROYLE says that in his experiments, when Petersburgh hemp broke at 160 lbs., and Bombay brown hemp bore 190 lbs., madár fibre also bore 190 lbs.

1747.—[4838]. Fibre of the lotus *(Nelumbium speciosum)*, from village Jinjan, Lahore district. PANDIT RADAKISHN.

The sample consists of a set of little hanks of a

* ROYLE'S Fibrous Plants, 307.
† *See* also under Drugs for this plant.
‡ Himalayan Botany, 275.

soft yellowish white thread. The long stalks of the lotus are pulled up, and broken at one end, when the ends of the threads which are contained in the stalk appear; these are gently pulled out and wound off.

The principal use of the fibre is for the wicks of sacred lamps, in Hindú temples, but it is said by Hindú doctors that cloth woven of the fibre has medicinal virtues, and acts as a febrifuge.

1748.—Cotton from the *Bombax heptaphyllum.*

Another common product is the cotton from the sembul or cotton tree. It is only found somewhat sparsely distributed in the Punjab, and also in the lower hills of Kangra and Hushyarpúr.

The short-stapled whitish cotton is not produceable in sufficient quantities to be made an article of trade, it is used to stuff pillows with.

Cotton from *Bombax heptaphyllum* was sent from

(4791) Kangra (foot of the Hills).

(4797-81) Hushyarpúr.

(4840) Lahore (CHAUDRI EMAM BAKSH).

The ripe fruit of the "paláeh" or "fálsch" *(Populus ciliata)* yields a short downy cotton that is not unlike this substance. I have seen paths in the hills, near Murree, in the month of August, strewed with this cotton falling from the trees like snow.

1749. Himalayan nettle fibre (*Urtica heterophylla*) (*Urticaceæ*). *Vern.*—Bichúa; allú; garain; chichrú.

This plant is of very wide distribution, being found in Assam and Burmah, in the Southern Concan, on the Malabar coast, and on the Neilgherries, and in the Northern Himalaya.

The plant is an annual, with erect, angular stems, marked with small white specks, in which are inserted stiff and acute bristles. The leaves, which are long and large, are covered with bristles and deeply serrated at the edges.

DR. ROXBURGH calls it "a ferocious-looking plant," and indeed its sting is very severe, but the pain of short duration.*

The fibre is long soft, white and silky, and would probably produce fabrics of a beautiful texture.

The common nettle of the Himalaya, is called "bichu,"† or "alú."

The plant abounds in the ravines and valleys during the rainy months, and forms one of the rankest weeds, rising to a height of 6 or 7 feet.

DR. CLEGHORN wrote to the Agri-Horticultural Society, Punjab :—

"The *Urtica heterophylla* (the species cultivated by MR. MCIVOR at Ootakamund) is plentiful in Simla, having followed man to the summit of Jako, attracted by moisture to an elevation unusual for any member of the family. It is found within the stations of Dalhousie and Dharmsalla, and at many intermediate points. The quantity is surprising, wherever the soil has become nitrogenous by the encamping of cattle; the growth at this season also is luxuriant in shady ravines near houses, where there is abundance of black mould, but the sting being virulent the plants are habitually cut down as a nuisance, both by private persons and Municipal Committees.

1750. Fibre of *Nussiessya hypoleuca* (*Bœhmeria salicifolia*). *Vern.* — Sihárú. Called chainchar and chainjli in Hazára.

Not yet recognized as a merchantable commodity.

The fibre is valued for net ropes, on account of its resisting the action of water. The fibre, it would appear, is prepared by the hill people without steeping. It is merely dried, and when brittle is beaten, and the fibre separates easily; the plant is cut in October.

But DR. ROYLE, quotes CAPT. RAINEY, when Political Agent at Sabáthú, who describes the process of preparation as more laborious.

The plant being cut is exposed one night in the open air. The stalk is then stripped of its leaves and dried in the sun; when dry, it is placed in a vessel with water and wood ashes, and boiled for 24 hours. After boiling the fibre is well washed in a stream.

The fibre is then sprinkled with flour of the grain "kodra" (*Paspalum scorbiculatum*), and left to dry, is then ready for spinning, &c.

The celebrated *Caloi* fibre of Sumatra is yielded by *Urtica tenacissima*, which is identical with *Bœhmeria nivea*. The rhea fibre of Assam, which is the

* The *Urtica crenulata* appears to be the worst stinger of the family. LESCHENAULT DE LA TOUR, says, "that in gathering a piece in the Botanic Gardens of Calcutta, one of the leaves lightly touched three fingers of the left hand. In about an hour the pain became severe, as if the finger was rubbed with a hot iron. There was no appearance, however, of swelling or inflammation. The pain soon spread along the arm as far as the arm pit. He was than seized with a frequent sneezing and running at the nose, as if he had caught cold. He then experienced a contraction of the back of the jaws: the pain did not abate for 3 days, and was not wholly relieved till after 9 days had elapsed." LINDLEY, Veg. Kingdom, page 261. The stinging nettles are the *Urticas*, the stingless come under *Bœhmeria*.

† The name for a scorpion, probably given to this plant on account of its stinging powers. Fibrous Plants, 372.

same as the "Chú ma," or China grass, is the product of the same stingless nettle. The "ban" or wild rhea, is also yielded by a *Bœhmeria;* another and similar species (if it be not identical) is described under the name of "mesakhi:"* a gigantic nettle is described in Garhwal as growing to a height of 12 or 14 feet!

The species of fibre-yielding nettles are as follows:—

1. Rhia, Rámí, Caloi (Sumatra) Kaukhúra (Rajpúr), China grass, *Bœhmeria nivea* (*Urtica tenacissima* of Roxburgh).

2. Sihárú (Kangra hills), Tulsiárí, Chainchal (*Nussiessya hypoleuca*), (*Bœhmeria salicifolia*).

3. Bon or jungle Rhea. *Bœhmeria sp———?* (Lípiah of Naipál).

4. Mesákhí. (*Bœhmeria sp———?*)

5. *Bœhmeria lobata* (Ullah). Sold for hemp at Almora, and is common in Garhwal and Kamaon.

6. Púah fibre (*Bœhmeria frutescens*), (Naipál and Sikhim, and Garhwal). Besides these *Bœhmerias*, *B. macrostachya* and *Goglado* are found.

The other species are—*B. rotundifolia*, *B. pulcherrima* (changar), *B. argentea*, *B. dichtoma*, *B. moniliformis*, *B. trinervata*, *B. nervosa*, *B. macrophylla*.

7. Chorputta or Surat (E. of Bengal), *Urtica crenulata*.

8. Nilgirí and Himalaya nettle, Horoo Surat† Assam (*U. heterophylla*). Chichrú, bichúá, &c., of the Himálayas.

9. Jarkandálú, Kandálú and Kabra (probably *U. heterophylla*).

10. *Urtica virulenta* (Dera Dhún).

11. *Urtica parviflora* (Rohilcund), (Bichu, shishona).

12. *U. pentandra* and *heptandra*—Jephul jan.

13. *U. paniculata*.

14. *U. reticulata*—Salgárí.

15. *U. longispina*—Jalgára.

16. *U. filiformis*—Singhar.

17. *U. atrofusca*.

18. *U. funicularis*.

19. *U. dolabriformis*.

In the Jammú hills a species of nettle is produced called "sadar."

The great length, pure white color, and fine texture of the nettle fibre, would seem to indicate success in the production of fabrics, for which the finer flax is used; and it would probably, like the China grass, exceed flax in delicacy and beauty.

The coarser varieties are likely to suit for ropes; as also the outer bark which makes a strong rope.

The wild rhea fibre, when worked into a five-inch rope did not break till a weight of 9 tons, or 21,025 lbs. was attached; and other experiments have shown its strength to be nearly three times that of Petersburg hemp.

Besides these fibres, some species are medicinal and edible.

The roots of *U. tuberosa* are boiled as an article of diet, and the leaves of *B. caudata* are esteemed in Brazil a remedy for hœmorrhoids.

U. nivea if salted will curdle milk like rennet.* There are other species also useful in medicine.

The samples of nettle fibre were:—

Simla States, under the name of "bichúá."

(4738) Bagal.

(4741) Mahlog.

(4744) Kotí.

(4748) Balsan.

(4750) Baghat.

(4752) Tiroch.

(4756) Karaiti.

(4757) Jubal.

(4760) Hills near Simla (Mr. Geo. Jephson).

Kangra hills, from 5,000 to 9,000 feet, 4,765 on the outer range, called chichrú; kiñji (Hazára); sazankai (Pashtú); "the stinger."

It grows to a height of 8 or 10 feet in the rains, in places where sheep had been penned during the route across the ranges. The "gaddis" make coarse ropes of it. They strip off the bark when dry, it is called "garain" or "bichú."

(4821). Thick rope from the bark of do.

(4766) "Sihárú," foot of the hills, Kangra (*Bœhmeria salicifolia*) now *Nussiessya hypoleuca*.

1751.—*Onoseris lanuginosa*, kafi (Kangra);† kat katulla (Hazára, &c.); kasbal (Sutlej, &c).

There is another plant, yielding a fibre, or rather strips of a fibrous snow-white substance, which form the tomentum over the back of its leaves.

Royle says "it is called kapási" (from "kapás," cotton), and that "it is used as tinder in the Himalaya:" also, "he adds, that a coarse kind of blanket, called 'karkí,' is said to be made of this substance by the hill people, north of Dera Dhún."

The following account of the *Onoseris* is from Captain Huddleston's Report.

The "kupassee," as it is called, from its leaf

* Journal Agri-Horticultural Society, VII., 215.

† Royle, also called "serpat" or "herpat" by the Bhootias; and "theng mah" (Chinese).

* Lindley's Vegetable Kingdom.

† Fibrous Plants, 302. Nat. Order. *Asteracea compositæ.*

being similar to cotton, is, I believe, the tinder plant.*

* * * * * * *

It is a small plant with a broad leaf, which yields a fibre like cotton, and the white skin is stripped off the bark of the leaf. The leaves are plucked in July and August, one maund of which will give about a seer of "kupassee," which is torn off the leaves the day they are plucked, and given to a weaver for being made into a thread, from which small bags are made, the bags sell about 6 annas each, but will not bear wet, and the thread is very weak and rotten. It takes 4 or 5 men to collect the cotton for a maund of leaves, but it is not in very general use. The fibre also makes very good tinder. The plant is not collected for sale, but only by the natives for their own use.

II. FIBRES MAINLY VALUABLE FOR ROPE MAKING.

1752.—Hemp, *Cannabis sativa* (*Cannabis indica*). *Vern.*—Bhang; ganja; ganjika (Sans.); hinab (Arabic), (from this last are derived Greek κάνναβις; the Dutch hennep; and our "canvas;" French, chauvre," and "hemp."

It is remarkable that the three great staple fibres—cotton, flax, and hemp—should all be indigenous to Asiatic countries, if not to India itself.

The origin of this plant is indicated by its name, being of Asiatic origin, and giving rise to all other European names, the Sanscrit and Persian alone being different.

It is cultivated everywhere in India for its intoxicating leaves and gum resin, and grows up into the hilly regions of the middle and lower Himalaya.

Dr. Royle† says he has seen it 10 to 12 feet high at 6,000 and 7,000 feet. Notwithstanding its common destination of producing only bhang, the fibre has in some places been used, and a coarse cloth for grain bags, and even for personal wear, such cloth being called "bhangela," is made in the Himálaya, and a strong rope, called "sel." Shoes or knotted sandals are also made of hemp twine. (*See* Royle's Fibrous Plants, p. 327). Dr. Royle quotes Kirkpatrick's account of Naipal, and General Hardwicke, in support of this, and he adds he himself obtained rope and cloth in Kashmír.

The use of the fibre was perfectly well known also to the ancients.

In the fourth book of Herodotus (c. 74-75), the author referring to the manner and customs of the Scythians, says, "they have a sort of hemp growing in this country very like flax, except in thickness and height, in this respect the hemp is far superior; it grows both spontaneously and from cultivation; and from it the Thracians make garments very like linen, nor would any one who is not well skilled in such matters distinguish whether they are made of flax or hemp, but a person who has never seen this hemp would think the garment was made of flax." The plant is called by Herodotus "cannabis," the same word which we now use, and from which the English word canvas is derived.

To the present day it grows in Northern Russia and Siberia, Tauria, the Caucasus, and Persia, and is found over the whole north of Europe.

We next hear of it in Pliny, who describes the hemp-plant as being well known to the Romans, who manufactured a kind of cordage from it. This author has minutely described in the 19th book of his Natural History, the mode of cultivating it, and its subsequent preparation in order to obtain the fibre.

For an account of the intoxicating leaf and resin yielded by this plant, the reader is referred to Division I., Sub-class (E), on Intoxicating Drugs.

The distribution of hemp is very wide indeed. New Zealand forwards a supply as well as Italy; but that of the latter country yields the best, the whitest and the softest. The dry warm climate of the country appears peculiarly suitable to developing the qualities of hemp.

The Italians have a saying that hemp may be grown everywhere, but it cannot be produced fit for use either in heaven or earth without manure!

Hemp when cultivated in this country for bhang, is sown thinly, but it is necessary to sow it thick, in order to make the plants shoot up into tall wands for fibre. The thick growth of the plant produces shade, excludes light and air to some extent, and by keeping in moisture and shading off the heat, prevents the rapid evaporation of sap.

The possibility of the successful cultivation of hemp in India, was suggested as early as 1800 by Dr. Roxburgh*; although Mr. Deneef succeeded in growing excellent hemp in Bengal, and a fibre of good quality has been, and may yet be, produced in various parts of the plains, yet the hemp of the Himálayas of Garhwal, Kamaon and Kot Kangra, is very far superior in strength; even at Saharanpúr, where the bhang plant was made to grow to a height of 10 to 12 feet. Dr. Faulkner reported that the fibre was not equal in strength to that of the Himálaya.

* It is to be found at elevations from about 5000 to 9000 feet.

† Illustrations, p. 333.

* Royle's Fibrous Plants, 320.

A two-inch rope of Dera hemp bore up to 2,519 lbs;* but a sample of hemp from the division of Kúlú, in the Kangra district, did not break with 400 lbs., when rhea fibre gave way with 320 lbs., and Petersburgh hemp with only 160.

DR. JAMESON mentions that on showing some pattern samples of Russian hemp to some Hill cultivators, they said that if they produced such inferior stuff they would not be able to find a sale!

The estimated value of the Himálayan hemp is about £35 per ton. Hemp when first asked to be sent home by the Court of Directors, was procured at the rate of from 4 to 6 Rs. per maund (= £10 16*s.* and £16 4*s.* per ton), including cost of carriage to England, this would cost £25 16*s.*, or £31 4*s.* altogether.

The difficulties of rendering the fibre produced in the Himálayan districts a profitable article, are great, on account of carriage, though no doubt the produce of Garhwal and Kamaon will be greatly facilitated by the river carriage on the Ganges. The quantity of hemp actually under existing circumstances exported from India is large, and increasingly so, though the returns are not very trustworthy, from the high probability of sunn and *Hibiscus* fibres, and perhaps some jute, &c., being included as "hemp."

In 1803, the exports were only 4738 cwts., and 1851, *before* the great pressure of the Russian war, they had reached 590,923 cwts., which is an increase of more than one hundred-fold in 50 years!

We must now pass on briefly to consider the cultivation of hemp in the Himálayan provinces, and what methods are adopted for preparing the fibre. The following extract from a letter of MR. BATTEN, Senior Assistant, to MR. G. LUSHINGTON, Commissioner of Kamaon,† well describes the Himálayan varieties.

The natives divide hemp into three species, viz., Gunarabhunga, Goorbhunga, and Phoolbhunga. The first named kind is also called "junglee, or bun bhunga," and is that which is seen everywhere throughout the hills, growing wild; and indeed, during the rains, forming the chief portion of the rank vegetation, especially in the neighbourhood of houses. A little charras can be extracted from the flowering portion of this plant, and an inferior rope can be made from the fibres, but in general this species is considered and treated as useless. In cold situations, especially near the sheds of pasturing cattle, this wild plant often attains to the height of ten feet. In botanical character, there is I believe, very little if any difference between this indigenous production, and the true *Cannabis sativa.* "Goorbhunga" is the cultivated kind, and is grown from seed, the first introduction of which into the hill agriculture, whether from the wild plant of the country, or from elsewhere, is not now discoverable. The seed is always procurable in the bazar, and is generally sold at about Rs. 3 a maund. In the interior the price is often cheaper, and in Shor, about 16 nalees, or not quite thirty seers, are sometimes procurable for the rupee, when the seed is purchased for culinary purposes. The sowing takes place in the Hindoo months, Jeyth, Assar, or from the middle of May to the end of June. In warm situations the hemp is sown rather later, in order that the heat and damp of the rains may cease before the plant shall have time to run into useless stalk and excessive seed. During July and August, the ground about the plants is hoed, and fresh earth heaped up about the roots. The "goorbhunga" is ripe in Kartik, *i. e.*, from the middle of October to the middle of November. Cold and high situations are almost exclusively chosen in Garhwal for hemp crops, and in that district I do not recollect ever having seen cultivated hemp below the level of 5,000 feet above the sea, and very rarely even at that level. It is generally to be found between 6,000 and 8,000 feet, but in Kamaon the situation of hemp-growing villages is rarely so high; and a cold climate, though preferred to that found at elevations below 5,000 feet, is not considered absolutely necessary. The favorite situation for the cultivation of hemp is a cold, dry upland ground, with a good soil, and with facilities for manuring, manure being most essential for the proper growth of the plant. Hence we generally see hemp crops in the immediate neighbourhood of the village homesteads, or if at a distance from human habitations, very close to cattle-sheds and pasturing grounds on the upper ranges of mountains. Hemp crops is supposed to exhaust the soil, and the wheat and barley, which are commonly sown in succession thereto, are said to be defective in quantity and quality. The "phoolbhunga" is described by all my native informants as self-produced in the field where the "goorbhunga" is sown. As far as I can judge, however, it is merely the barren plant.* It produces a blossom, but no seed, and the leaves are exactly similar to those of the "goorbhunga." This plant ripens earlier than the "goorbhunga," and is that which has the most valuable fibre. It is useless for the production of charras.

The culture of hemp is as follows:—

The ground is cleared at the end of May or in the

* *See* Journ. Agri-Hort. Society, III., p. 227.

† Papers on the hemp cultivation in India.

* It is the male plant. Hemp is Diœcious.

beginning of June; the quantity of seed is about from 26 to 33 seers, 9 seers per acre (which is nearly the equivalent of the "besi" of Garhwal).

During their early growth the plants have to be kept free from weeds, then the crop will grow up to even 12 or 14 feet, and is cut in September to November.

The male plants produce the strongest fibre, and are cut some weeks earlier, the stalks are then dried somewhat, and made into bundles and steeped for 8 days or more, they are then taken out, beaten with wooden mallets, and dried; the fibre is stripped off, from the thickest end of the stalk, and is again beaten and made up into twists for sale.

The average return per "besi" or acre is—

	Value.
3 seers of "churras,"	6
4 maunds of hemp,	8
30 to 35 seers of seed yields 5 seers of oil,	1
	Rs.* 15

It is curious that in some parts of Kamaon the cultivation of hemp is looked on as a mean occupation, and "hemp-grower" is a term of abuse, the same contempt is felt in parts of the Dekkan for the cultivation of "san."†

In the plains, hemp is always manured, bearing out the Italian proverb before alluded to. In Europe, hemp is either steeped in water, either standing or running, the former appears on the whole the best; or else is subjected to "dew-retting," and in Russia to "snow-retting;" the latter processes are complete when dark spots appear on the hemp stalks: after this they are dried by being spread out on grass, they are then peeled by breaking the end stalk and slipping off the bark; it is then subjected to the break, or "brake," between fluted rollers, and then scutched and the longitudinal fibres separated by beating.

The probable costs of carriage, &c., are clearly detailed in the following paragraphs of a letter from J. H. STRACHEY, ESQ., Assistant Commissioner, Garhwal, to J. H. BATTEN, ESQ., Commissioner of Kamaon, No. 41, dated 28th July, 1854.

"Assuming the price at the foot of the hills to average Rs. 6 a maund, the cost per ton will be about Rs. 164.

"I have no data to enable me to give the cost of transport from the foot of the hills to Calcutta with any exactness, but it will probably be about Rs. 45 per ton. CAPTAIN CORBETT'S estimate from Suneah, Chilkeea, and Kotdwara, is £4 4*s.* per ton; CAPTAIN HISKE'S, from Dehra, is £4 2*s.*; I will assume it to be Rs. 50, which will I believe be considerably above the actual cost; and this will give for the price of the hemp in Calcutta, Rs. 214, or say £21 8*s.* per ton. DR. ROYLE states that it may be assumed that a price of at least £35 per ton will be given in England for fibre of superior quality. I assume, which I believe I may very safely do, that the Kamaon and Garhwal hemp will be at least equal to the best Russian. At this rate we have £13 12*s.* to cover the freight, and all other charges between Calcutta and England.

"There can be little doubt, under these circumstances, that the Himálayan hemp may be profitably exported to England. It must be remembered too, that while I have estimated the price of the hemp at Calcutta at a sum that will in all probability be above its actual cost, the price mentioned by DR. ROYLE, as obtainable in England, will almost certainly, for some time at least, be very considerably increased. I have not the means of ascertaining the present price of hemp in England, but £35 per ton, the sum which DR. ROYLE names,* has not been an unusual price for the best Russian and Italian hemp, even in time of peace, and at one time, during the last war, the price rose to £118 per ton, while even the Indian jute, which usually sells at £12 to £15 per ton, rose at one time to £35 and £40 per ton.†

Although we must not assume that war prices will last for any great length of time, the quality of the Himálayan hemp appears to be so admirable, that when it has once become known in the English market, it will certainly always fetch a high price.

In conclusion, the following suggestions as to the preparation of the fibre and the best way of establishing its reputation in the market are extracted from the "Papers concerning Hemp Cultivation."

"The culture seems to be very well understood in many parts of the Hills, as they carefully prepare, and usually manure, the ground, thin the plants to within three or five inches, and cut the male plant, "phúl bhanga," which flowers, but has no seeds, a month or six weeks before the female plant, 'gulanga,' or 'gulbhanga,' which has seed, the latter being cut about the end of September.

"As the preparation is also understood, the cultivators should be required to do this in their best way, so as to produce a clean and uniform article, in long

* ROYLE p. 323. No account is taken in this of the value of leaves as "bhang."

† For an account of the cultivation in Naipal, *see* ROYLE'S Fibrous Plants, 323.

* DR. ROYLE wrote before the commencement of the war in Europe.

† MCCULLOCK'S Commercial Dictionary. Art. Hemp.

lengths, without twisting or platting the ends up in any way, and to resemble the Petersburgh hemp as nearly as possible.

"The hemp sent by D. F. McLeod, Esq., as the produce of Kúlú and Lahaul, having been highly approved of in this country would no doubt sell well, if sent to market. It is desirable therefore to send a sufficient quantity, to have its properties more extensively tested, and its value established in the English market.

"Though it will, no doubt, be necessary in some cases to increase the original price of these fibres, as in the case of the hemp, or perhaps of the rhea, for a time, so that when more extensively cultivated its cost shall have been ascertained, it is to be carefully kept in view that any great increase of price in the articles will prevent their becoming permanently established as articles of commerce, as that would interfere with the profits of all those engaged in the transaction. Though the price of all fibres is at present high, it is uncertain how long this may continue; but it may be safely assumed that if care be taken to make their superior quality known to proper hemp brokers, that all which have been mentioned will come into competition with the best kinds of hemp, and sell for about £35 a ton.

The following list shows the weights at which fibres tested at the Military Stores, respectively broke :—

	lbs.
Petersburgh clean hemp, ...	160
Wild rhea, ...	343
Jubbulpore hemp, ...	190
China grass, ...	250
Rhea fibre, ...	310
Kot Kangra hemp, no breakage at, ..	400
Wukkoonar fibre, ...	175
Yercum or mádar fibre, ...	190

"Clean samples of all the above fibres were taken, of equal weights and firmly tied at their ends, so as to be of equal lengths, at the India House, and their strength tried in the usual way by Mr. Hull, in the Military Stores.

The samples of Himálayan hemp (bhang), (*Canabis sativa*) were as follows :—

Simla States—
(4736) Bhaji,
(4743) Sirmúr.
(4745) Kotí.
(4747) Balsan.
(4749) Baghat.
(4753) Tiroch.
(4754) Rampúr of Basahir (Mr. Ter Arratoon).
(4755) Karaiti (Thakur of Karaiti).
(4758) Jubal.
Kangra (Palam valley).
(4824) Lahore Museum (from hills).
(4849) Lahore Museum (rope of Himálayan hemp.)
(4896) Gujranwalla ("bhang-ka-chál"), (the fibre of the bhang plant).
(4915) Gujrat (specimen of rope also).
(4978) Kashmír (post bhang).

1753.—[ ]. San (*Crotalaria juncea*).

This plant is often confused with the "sankokra," (called sanní in some parts), *Hibiscus cannabinus*, to which it is much superior in strength. The species is known in commerce as "sunn hemp," Concanee hemp; Salsette or Bombay hemp; and brown hemp. Though called hemp, it is hardly necessary to observe that the plant has no connection botanically or otherwise with the true hemp (*Cannabis sativa* or *Indica*).

Dr. Royle remarks on the similarity of the Spanish broom (*Spartium*) to this plant ; the former is well-known at home from the tough fibrous nature of its branch twigs. As early as the close of last century, sunn began to attract attention in Europe, and a treatise on hemp and the Sun Plant, was brought out by Wisset in 1804.

The san plant is cultivated all over India. The "wukkoonar," fibre of Travancore, though different at first sight, is really the *Crotalaria juncea* somewhat altered in its growth by locality and climate.* "San" is also produced on the Malabar coast, and in the Bombay presidency. The Jabbalpúr hemp is produced by *C. tenuifolia*, which Wright and some other botanists consider to be only a variety of *C. juncifolia*; but Royle makes it a different species.

The time of cultivation for "san" is generally during the rains. A clayey low-lying soil is bad; a high, somewhat dry situation, is best; and a too rich soil produces coarse fibres. The "san" is sown thickly. If the seed is sown when the first shower falls in June, in August or September, the plant will be in flower, and from 5 to 8 or 9 feet in height. If the plant be wanted for fine soft fibre, it is cut in flower; and if for strength it is grown until the seed ripens, before cutting. The plant is either cut or pulled up by the roots like flax. The produce of an acre is given by Royle at a medium of 700 lbs.

The san after being cut is steeped. According to the climate and seasons, the duration of the steeping is fixed. In August and September, 2 or 3 days are sufficient,† the completion of the process is known by the facility with which the bark separates. At this stage, workmen go into the water, take up the stalks in

* *See* Royle's Fibrous Plants, p. 285.

† If cut when the seed is ripe the fibre requires much longer steeping.

handfuls, and heap them in several places; they then grasp the bundle by one end, and beat it on the surface of the water, which quickly removes the cellular matter from the fibres: they then turn the bundle, taking hold of the other end, and treat it in a similar manner. The natives to complete the process merely wash the fibre, and hang it up on branches to dry. A hemp brake and scutching machine are unknown, and might be advantageously introduced.

The great point to be attended to, in preparing fibres of woody plants is to get rid of the sap and vegetable matters as soon as possible; it is the fermentation of these that hastens the decay and weakening of the fibres.

Of the value of "san" for a rope fibre,* there can be no doubt. CAPT. THOMPSON of the firm of THOMPSON & Co., ropemakers, Calcutta, wrote of some Malabar "san" that it was equal for mill purposes to Russian hemp, and that if well prepared it might completely supersede the Europe made cordage. Some interesting particulars about the strength of san are given by DR. ROYLE, at page 278 of his "Fibrous Plants of India."

A sample of san fibre sent to the Exhibition of 1851, bore only 150 lbs., but an older sample received in 1802, bore 175 lbs., and Petersburgh hemp gave way at 160 lbs.

The value of good san appears to be from £18 to £20, and £25 a ton in England, while the "wakkúnar," was worth £35.† In 1854 (December) san was as high as £33. Of the san fibre, MR. DICKSON said, that when prepared with his Patent Liquid, it "became soft, white, and so fine, when heckled, as to bear the closest comparison with flax at £80 per ton. It is better than any Russian flax for fine spinning."

The other species are *Crotalaria tenuifolia*, Roxb.; *C. retusa*, L., called "bil jhanjan" in Bengal; *C. verrucosa*, L. (*C. cærulea*), "bansan."

I cannot better conclude these remarks on hemp cultivation, than with the observations of DR. JAMESON.‡ After detailing the form in which Russian hemp comes to market, and the system of advances, &c., practised, he says, in para. 11—

"I have mentioned these particulars to the Board, in order that they may see how the important trade of hemp and flax is carried on in Russia, and which might with much advantage be imitated in this country. For Government to do so on a large scale is not necessary, but to bring about a brisk and thriving trade, the initiative must, I think, be done by them, and the remainder might then be left to the mercantile community. Let a system, similar to the Russian, be introduced into this country, viz., small advances or "hand money," paid to natives, and inspectors appointed to give advice on cultivation and preparation, and I am confident that the North Western Provinces would turn out any supply of good fibrous stuffs. But it must be first ascertained, by the transmission of samples, that the fibrous stuffs are fitted for the home market, and that they can realize prices in England, to admit of a small advance on the rates of sale now prevailing in India, and thus admit of better cultivation, and more care in preparation, and thus the production of better fibres. But before this can be effected, in a country where indolence, apathy, indifference, and want of zeal prevail, an inspector or inspectors, as stated, must be appointed."

The samples of "san" or "sanni" (*Crotolaria juncea*) were as follows:—

(4722) Hissar. Value, 4 Rs. per maund (sown at the edges of fields).

(4724) Rohtak.

(4731-32) Ambálah, of two qualities.

(4768) Kangra (Haripúr).

(4817) Lahore.

This district also exhibited from the Tahsil of Sarkpúr, a sample of the plant unprepared, with its leaves and seed vessels, &c.; and a sample of rope from the "san" made at the Central Jail (4848).

(4936) Gugaira (sanni).

(4960) Dera Ghází Khán (sanni).

(4969) Peshawur.

(4693) Kapúrthalla.

(4978) Kashmír.

(4982) Nabha.

(4987) Pattiala.

(4990) Maler Kotla.

1754.—[4702]. Wild hemp, "janglí san." Spiti. KANGRA LOCAL COMMITTEE.

1755.—[4912]. Old gunny cloth and tát, used in paper making. GUJRAT LOCAL COMMITTEE.

1756.—[4933]. "Khip" or "khif" (*Crotalaria burhea*). Thal of Khúshab, Shahpúr. DEPUTY COMMISSIONER.

Called a *Leptadenia* in the Local List. It is used for making rope (*see* Plate).

1757.—Jhijjan (*Sesbania aculeata*), (formerly *Æschynomene cannabina*, Roxb. Flor. Indica, III., 335).

* It is mentioned by DR. BUCHANAN HAMILTON, in Mysore, as making a stout gunny cloth also.

† ROYLE's Fibrous Plants, 286.

‡ In his Reports addressed to the Board of Revenue, on Fibres, submitted 1855. (Hemp Papers).

CROTALARIA BURRHEA.

A few specimens of this fibre appear. Two grown near Lahore, and some from Gujranwalla and Gugaira were exhibited; it is like "san," but somewhat coarser and darker colored. It is highly probable that this is the *Sesbania aculeata* formerly *Æchynomene cannabina*. The plant is called "dhandain" in the North West Provinces, and *jaganti* or *jajanti* in Bengal, and a fibre very similar, the *Crotalaria retusa*, is called *Bil jhinjan*. It is said to spring up in rice fields, and other wet cultivation during the rains. When cultivated it is sown after the first showers of the rainy season, and requires less weeding than "san," but a low and moist situation; it is ready to cut about November. It will grow as high as 6 to 10 feet in Bengal, and is supposed to be very suitable for water cordage, as it does not easily rot. This is the same as the "dhunchí" fibre, which was valued at from 30 to £35 per ton.

Mr. Deneef* showed a sample to the Agri-Horticultural Society in 1840, and said that a begah would yield 173 lbs. of fibre, and 92 of seed. A woman can dress 4 lbs. of fibre in a day.

In 1862, "jijjan" was noted as having recently come into use at Lahore, owing to the high price of other fibres: the Punjábí samples though strong, are coarse and badly prepared, and are not worth more than £8 or £10 a ton.

Samples of the "jhijjan" plant were sent from—

(4825) Lahore (grown at Sanda), by Chaudri Imam Baksh.

(4826) Fibre of do.

(4853) Rope of do. (obtained from Gujranwalla).

(4939) Gugaira.

1758.—Sankokra (*Hibiscus cannabinus*), (Malvaceæ); sankukra; sanukra? sanni (Saharunpúr), &c.; patsan, Delhi; ambarí (Hindústán, westward); méstabít (Bengal).†

This is a long fibre-yielding plant, which makes a good fibre for matting, &c., but is weak in comparison with "san" and "jhijjan."

It is the produce of a tall *Malvaceous* plant, distinguished by its large sulphur-yellow flowers, with purple centres. It is usually sown as a kind of hedge on the borders of other crops, and requires about three months to come to perfection.

It is steeped and prepared like "san." "Dr. Roxburgh, when experimenting with this fibre, found that a line made of fibres from plants *in blossom* broke with 115 lbs., but, with only 110 lbs. when the fibre was from plants whose seed had ripened." And in Dr. Wright's experiments, "sankokra" broke with 290 lbs. when "san" bore 404 lbs. When carefully prepared, the "sankokra" will divide into very fine fibres, and furnishes a fibre 5 or 6 feet long. There were samples of the fibre thus prepared from the Central Jail, where good door mats are made of it.

The leaves of this species are in some places eaten as a vegetable, having an acid flavor.

The calices of the Roselle plant (*H. sabdariffa*), are fleshy and acid, and are used as a fruit, and converted into a jelly under the name of "patwa."

The Roselle fibre is also good. *H. furcatus*, *H. mutabilis*, and *H. tiliaceus*, all yield fibres.

Malvaceous plants of the genus *Sida* yield cordage fibres in China.

The specimens of *Hibiscus* fibre (sankokra) were as follows:—

(4769) Kangra (Palam valley). Sells at about 12 seers per rupee.

Lahore Museum series—

(4821-23) The fibre in different stages, from the stalk just crushed to the perfectly developed fibre. A sample of the plant was also sent.

(4851) A rope of this fibre. Chaudri Imam Baksh.

(4897) Gujranwalla.

(4972) Kapúrthalla.

(4708) Delhi; where it sells at Rs. 2-8 a maund. The woody part is used for making lucifer matches.

Still within the produce of our 2nd division of fibres principally valuable for rope-making, we approach that series of fibres which was described in the preliminary notice on the botanical nature of fibres generally.

We here conclude the list of those fibres, which, belonging to the *exogens* or "outside growing" order, are separated from the cellular barks of the plants producing them, by the process of steeping, breaking, scutching, &c. It is these that form the more valuable fibres for the market, and they require much preparation; their final process, "heckling," separates from them all the shorter fibres, leaving the long uniform ones as the staple, and the residue as *codilla* or *tow*, useful in a variety of ways for coarse fibres, for packing, and for paper making, &c.

The series of fibres we now enter on are

* Royle, 295.

† In the Purneya district it is called "ambaya pata," and in Behar "kudrum;" the variety of its names shows how universally it is cultivated in India.

those barks of the stems and roots of exogens, where the external cellular bark is comparatively insignificant, and the inside layer of woody fibres, comparatively predominant and tenacious; so that the barks often yield a strong rope without further preparation than separation from the parent stem and twisting. Such are the following:—

1759.—[4751]. Bíhul, fibre of the *Grewia oppositifolia*. Tirwah (Simla). RANA OF TIRWAH.

Also a sample (4759) from Jubal (Simla). (4767) is a specimen from the foot of the Kangra hills by the name of *dhâman* or "bihul." "Dhâman" is also known in some places as "tháman," and "dáman" (without aspirate), or "táman." "Bimal" or "bhimal" in Garhwal and Kamaon. DR. JAMESON adds "bhengûl."* Its Pushtú name is "pastawane." Yields a strong fibre for ropes and nets: not exported.

A sample of a rope of "fálsa," among CHAUDRI IMAM BUSKH'S Lahore collection, and said to come from the Hills—may probably be *G. oppositifolia.*

CAPTAIN HUDDLESTON, describing the "bhímal" in Garwhal says, the leaves of the stalks are given to cattle, the stalks are then soaked in water forty days, and then beaten with stones to loosen the bark, which is afterwards peeled off. One tree gives about 5 seers of fibre.

1760.—[4761]. Tawar or tór, Elephant creeper. *Bauhinia racemosa*, Lam., or *B. scandens*, Willd., or *B. Valhii.* Hills near Simla. MR. GEORGE JEPHSON. Called also "gaj-bel."

The *Bauhinia racemosa* is also called "málú" and "máljhan" and "kandli" in Garhwal and Kamaon.

The plant is a climber with immense large two-lobed leaves, which dry a reddish-brown color, and are made into umbrellas in the lower hills (where the plant is abundant), by spreading them on a framework of bamboos, and netted with string to keep the leaves together; such an umbrella was exhibited from the Hushyarpúr district.

This climbing plant hangs in elegant festoons around other trees. There are two or three beautiful specimens over-growing lofty trees in the Badámíbágh at Lahore. The flowers are beautiful in appearance, and the seeds are eaten raw, and are said to be like ca•hew nuts. The fibre of the bark is sometimes softened by boiling, but oftener peeled off while green, twisted and allowed to dry. Specimens of *Bauhinia racemosa* ropes are mentioned by DR. ROYLE as sent to the Exhibition of 1851 from Bhagulpúr, under the name of *Patwa* or *Mawal* fibre.

The fibre of *B. scandens*, common in Silhet, was tested by MAJOR JENKINS,* and a line made of it sustained for 45 minutes a weight of 168 lbs., stretching only 6 inches in 3 feet. It is about the same strength as the best "san."

There was a sample (4776) from the foot of the Kangra Hills, where it is described as used to make ropes for bedding, and the bark, which burns or smoulders slowly, is used for a slow match.

The following description of the "málú" is from CAPT. HUDDLESTON'S Report on Hemp in Garhwal, 1840.

"The 'malloo' is a large creeper plant growing abundantly throughout the district at the bottom of narrow and hot valleys, along the sides and precipices of rivers and in ravines, forty or fifty yards in length and of considerable thickness, from the bark of which a very strong rope is made. The natives chiefly use it for tying up their cattle, and sewing their straw mats with the fresh bark; it also makes capital matches for guns, and muzzles for oxen and calves. The leaves, which are heart-shaped, and above a span in breadth and the same in length, are made into "chàttas," are sewed together with twigs for baskets for holding pepper, turmeric and ginger, and are brought to Sreenuggur in great quantities for sale, being used by the poor instead of dishes to eat off, and the buneeahs wrap up their goods with them; a load of the leaves fetches about 2 annas: the broad flat seed of the pod is also eaten after being fried. This creeper is cut generally in July and August, though it may be cut all seasons, and the outer bark being stripped off is thrown away, the inner coating being used for ropes, as wanted, by being previously soaked in water and twisted when wet. A large creeper will produce a maund of fibre, called 'seloo.' The bark before being used is boiled and beaten with mallets, which renders it soft and pliable for being made into ropes and string for charpoys. Though this fibre makes very strong ropes, it is not over durable, and rots if kept constantly in water; it will last about 18 months, but requires occasional soaking, and I am informed that when coated with tar it does not last much longer. The fibre is not collected for sale, but only for the natives' own use as they may require it; but any quantity, I imagine, might be obtained, and at cheap rates."

* Catalogue, Saharunpore, 1854, p. 74.

* ROYLE'S Fibrous Plants, 297.

1761.—[4775].—Karálín or "kachnár." Kangra. LOCAL COMMITTEE.

This is described in the Local Catalogue as the bark of a large tree growing in the Palam and Kangra valleys. "Kachnár," given in the same list as a synonym, is the *Bauhinia*, the flower buds of which are eaten boiled with meat as a vegetable, and to make (as it is asserted they do) the meat tender.

There are no particulars given of its use as a fibre.

1762.—[4771].—Jáman kúmb. Kangra. LOCAL COMMITTEE.

No habitat or uses given: described as the fibre of a climbing plant, which has frequent knots or joints, which makes the fibre short. Fibre fine and white.

1763.—[4772].—Giddar kumb. Kangra. LOCAL COMMITTEE.

A climbing plant, bark used as a fibre, not described, and habitat not noted. Fibre white and coarse.

In CAPT. HUDDLESTON'S Report on Hemp Cultivation in Garhwal (1840), he describes evidently the *B. racemosa*, or "tawar," under the name of "kúmbí."*

1764.—[4777].—Lasúrá (*Cordia myxa*). Kangra. LOCAL COMMITTEE.

The fibre is not much used. A sample was sent (4881) in the Lahore collection.

1765.—[4865]. Gondni bark (*Cordia angustifolia* or *C. Rothii.*) CHAUDRI IMAM BAKSH.

The fibre was made into a rope for exhibition.

1766.—[4778]. Sálangan. Kangra. LOCAL COMMITTEE.

Undescribed, and little used. The bark of a tree.

1767.—[4779]. Dhák or paláh fibre. Kangra. LOCAL COMMITTEE.

This is the bark of the "palás" (called "paláh" in Kangra), *Butea frondosa*, which has often appeared, both as yielding a gum and for its flowers which form a dye, and now for its bark's fibre. This is not likely to become an article of commerce, but is useful enough locally for agricultural purposes. A sample of the rope was sent from Lahore (4857), and two samples from Pattiala—both of root and the fibre (4985-56).

1768.—[4839]. Bark of the *Celtis caucasica*, or nettle tree (Ulmaceæ). Chamba Hills. LAHORE MUSEUM.

The nettle trees (Ulmaceæ) are not to be confused with the nettle fibres of the Urticaceæ, &c. The sample is a thick rope of a brown color, and of considerable strength. It is used in Assam to make a coarse cloth.

The inner fibres of the bark are by natives reticulated into a kind of fabric. The leaves are said to be used in polishing horns.*

1769.—[4861]. Coir rope; cocoanut fibre (*Cocos nucifera*). Imported from Hindústán. CHAUDRI IMAM BAKSH.

This fibre is scarcely ever seen in the Punjab; and as there is no chance of its ever growing here, or becoming an article of trade, it is of little importance to the Punjab. It is not so strong as some, breaking at 204 lbs. when hemp bore 407 lbs.; but as a fibre for matting and as resisting the action of water and and other valuable properties, it is well known and an extensively exported article of commerce.

1770.—[4808]. Bark of the mulberry (*Morus indica*). Lahore district. CHAUDRI IMAM BAKSH.

The Moraceæ are not generally known as fibre-yielding plants, except as regards one or two of their number. *Broussonetia papyrifera* has a fine reticulated inner bark, which, in the islands of the Southern Ocean, makes a good and even fine cloth, and also a paper. As to the use of the white mulberry, ROYLE quotes MARCO POLO, who describes the Chinese as peeling off the thin inner bark of the trees on which the silk worms were fed, and then steeping the material, and afterwards pounding it into pulp in a mortar. The author adds, this is made into paper resembling that which is made from cotton.

The experiment of making pulp from the mulberry bark has actually been tried, and with some success.†

The mulberry tree is very common in the plains of the Punjab, and its bark might be utilized.

1771.—[4877]. "Resha bar" (*Ficus indica*). Lahore district. CHAUDRI IMAM BUKSH.

The long fibrous roots of the "banyan."

The tree throws down from its branches long aerial roots which finally thicken and take root again. It is very little used as a fibre, but exhibited to show what there is available. It is used, however, as a "falita," or slow match, for the native matchlock.

1772.—[4875]. Coarse rope, made

* See Paper on Hemp Cultivation. Appendix, p. xxiii.

* DRURY'S Useful Plants, p. 124.

† ROYLE'S Fibrous Plants, 343.

from the sugar-cane after the juice is expressed. Lahore. CHAUDRI IMAM BUKSH.

A coarse but strong fibrous rope: used for agricultural purposes, but it is too coarse and woody to be turned to account as a fibre.

A sample was sent from Gujranwalla (4898).

1773.—[4774]. Olín. Kangra. LOCAL COMMITTEE.

A fibre obtained from the sheaths of the leaves of a kind of palm (*Chamærops?*) which grows in the Kangra hills up to 5000 feet.

The last series of fibres are the grasses, or those endogenous plants, which yield fibre from the long leaves or sheaths enclosing the stem, like the plantain.

The grasses are exhibited in the form of ropes, merely dried and without preparation. In most fibre-yielding plants it is necessary to separate the mucilage, cellular, and the sap from the fibre (?) before it can be utilized. This is the case not only on account of the obstruction to the subsequent processes offered by the woody matter, &c., but because the presence of the sap tends to produce decay; but in the long narrow blades of grass, the quantity of foreign matter is so small and dries up so quickly, that the leaf simply dried is twisted into a rope.

Only one or two of these are extensively useful.

The plantain, of which is made in other parts Manilla hemp and fibres that are subjected to careful preparation, is in the Punjab only rarely to be seen as a fibre, and then the outer sheath is merely dried like a grass and twisted into a rope; otherwise, no doubt, the plantain should have been included in the textile fabrics as subjected to a course of preparation to obtain the fibre.

The production of this valuable fibre is yet a desideratum in the Punjab, and as the plant grows well enough, there can be no reason why it should not be. The *Saccharum moonja* is perhaps the only grass that is extensively useful. The other grasses are used for fodder, or for ropes, by the agriculturists only when they cannot get anything else.

1774.—[4862]. Rope of the plantain fibre (*Musa paradisica*). Lahore. CHAUDRI IMAM BUKSH.

The distribution of the species of Musa is very wide. There is the *Musa textilis* (Manilla hemp) in the Philippine Islands; several species in the Malayan peninsula; several in the Malabar coast and over the South of India. In Bengal it flourishes; and it is found up to the north of India, even to 30° of north latitude, and up to 4,000 or 5,000 feet above the sea level in Garhwal and Kamaon.

As regards the value of the plantain as a food-producing plant, the reader will find an interesting account of it at pages 69, 70 and 72, of ROYLE'S Fibrous Plants.

In the Punjab the variety of the fruit commonly seen is large, and somewhat insipid, and inferior to the small and pleasant-flavored plaintains of Bengal.

The art of making flour from the plantain, or preserving the fruit is, I believe, unknown in the Punjab.

It is said that the plantain will grow in the poorest soil and near even brackish water. "A sucker being planted, soon attains maturity—some varieties in 8 months—others within the year, each producing a bunch of fruit, which may weigh from 25 to 40, and even 90 pounds. Each throws out from its roots and around its stem from 6 and 7 to 8 and 10 fresh suckers. These form each a distinct plant." The suckers are cut down annually.

The fibre may be easily separated by scraping the pieces of the stem and sheaths on a flat stone or board, with a piece of hard wood, made like a wooden knife.

The leaf stalk from which most fibre is obtained (as also from the inside of the leaf), has the greatest quantity of the cellular pulp which has to be removed on its upper surface, that should therefore be scraped first, and then turned over and the other side scraped; the fibres are then washed to free them from pulpy matter, and dried *in the shade*. The sun-drying gives the fibres a brownish tinge. In the West Indies the plantain trees are cut down and heaped together, and allowed to ferment, which softens the cellular, and allows of the easy separation of the fibre, but this must weaken it. The expressed sap is said to have tanning properties.

These plants might be cultivated in jail gardens and made much use of. As yet in the Punjab the plant is comparatively uncommon. Paper of excellent quality has been made of it at the Gujrat Jail. Of this mention will be made hereafter.

1775.—[4874]. Bark of the carda-

mon-plant (*Elettaria*). Lahore. Chaudri Imam Baksh.

The cardamon plant grows in the Punjab, but does not fruit. The leaves and sheaths of this plant, and other *Zingiberaceæ* no doubt abound in fibre, being similar on a smaller scale to the plantain fibre. The sample sent was more as a curiosity and a sample than a fibre used or recognized.

GRASSES.

1776.—[4712]. "Káns" (*Saccharum spontaneum*). Delhi. Municipal Committee.

1777.—[4713]. "Dáb" grass, or "dabhah." Delhi. Municipal Committee.

This is the *Anatherium muricatum*.

This grass is also called *khawi* or *khavi*, under which name specimens were sent from—

(4932) Khúshab of Shahpúr.

And also *panni*, under which name specimens were sent from

(4873) Lahore.

(4938) Gugaira.

The root or "khas" will be noticed among Thatching Materials. The flower of the grass is called "*gul-i-izkhar*," and is used for flavoring and scenting in distilling spirits, and in medicine.

1778.—[4714]. Múnj (*Saccharum munja*). Delhi. Municipal Committee.

This most useful grass is very common in all parts, and grows under several names. The leaves are long and narrow, and grow in large tufts around the base; the flower stems, which are surrounded by the sheaths of leaves, which appear at intervals up the length of the stem, rise to a height of 10 or 12 feet, and are crowned with a wavy grass flower, which has an exceedingly elegant appearance; the sheaths of the stalk are covered with minute spiculæ, which are painful if the plant is roughly grasped. The leaf sheaths surrounding the stalk, as well as the dried leaves on the flower stalk, furnish a material, which, when slightly damped, is twisted into twine of various degrees of fineness and considerable strength; and if well made, presents a beautifully neat glossy appearance.

The tuft of true leaves at the base is called "sar" or "sarkara," and is only used in thatching houses (*see* Materials for Thatching and Matting).

The tall flower stem, stripped of the involucre, is a glossy jointed light stalk, this is called "sarkanda" or "kánná." They are collected, and when a number of them are arranged and kept together by strings passed through them consecutively at proper intervals, they form an open screen or "chick" for verandahs, which admits air, but excludes the sun's rays. A number of ingeniously made chairs, sofas and stools, are made out of "sarkanda." The reeds being placed across and across like lattice work, are bound together with "múnj" string; the seats of the chairs, &c., are made of string platted and interwoven, which are sometimes covered over with leather, and are a light, cheap and useful furniture. The tapering tops of the flower stem, after the ripe seed has been brushed off, form what is called "sirka" or "sirki," and are formed into a kind of thin thatching.

Múnj grass was exhibited from—

(4782) Kangra.

(4918) Jálandhar.

(4928) Bhera (Shahpúr).

(4963) Dera Gházi Khán.

(4974) Kapúrthalla.

(4988) Pattiala.

(6967) Peshawur (Yusufzai).

The fibre when the leaves are dried and arranged in bundles and ready for string-making, is called "bán múnj."

A specimen was sent from—

(4896) Gujranwalla, and Jhang (4944).

Múnj rope was exhibited from Lahore (at the Central Jail).

(4846) Extra thick rope.

(4844) Thick rope.

(4845) Medium rope.

(4847) Twine.

The fibre sells at 2 or 3 rupees a maund in October and November. It does not rot by exposure to wet.

1779.—[4783]. "Bagar" grass (*Eriophorum cannabinum*). Kangra district. Local Committee.

Teliyás is given as a synonym in Kangra. A sample (4842) was sent from Lahore, but was noted as being brought from the Hills.

Captain Huddleston gives the following account of it, but under the name of "bhábar."

"It affords a most economical substitute as an article of cordage in lieu of others of a more costly and durable nature. All the 'jhúlas' or rope (suspension) bridges which are erected over the large rivers, where 'sanglás' or wooden planked bridges, cannot be made, on all the principal thoroughfares of this district, are constructed of this silky species of grass, the cables of which, are of a considerable thickness.* These

* Jhúlas are almost invariably made elsewhere of the twigs of the *paser*, or *Parrotia Jacquemontiana*. On the Jhilam, near

rope bridges are a very safe means of communication over the large and rapid rivers intersecting different parts of the country, both for travellers and men with loads; and, where the footway and sides are properly laced with brushwood, afford an easy enough roadway for loaded sheep—but neither ponies or cattle can travel over them. This grass grows abundantly in all the ravines up the sides of the mountains, and is to be had only for the cutting—but it is not of a very durable nature, though pretty strong when fresh made into ropes. It lasts about a twelvemonth only, or little more, and the people in charge of the rope-bridges are constantly employed in repairing and annually renewing the ropes and stays. The 'chinkas,' or temporary bridges, of a single cable, upon which traverses a seat in the shape of an ox-yoke, are also sometimes made of this grass, though these are oftener made from the rope of the 'malloo' creeper, as being stronger and more durable from their being easily let down to soak occasionally in the water. The 'bhábar' grass is made into ropes without any previous preparation save that of being wetted."

1780.—[4733]. Bhábar grass (*Andropogon involutum*). Ambálah district. Local Committee.

Also from Delhi (4712A); the Salt Range (4931); and Jalándhar, where it is called "bhabbar."

1781.—[4854]. Dib grass (*Typha angustifólia*). Banks of the Rávi, Lahore. Chaudri Imam Baksh; also (490) from Gugaira.

Value about Rs. 2 or 1-8 a maund. Mats are also made of it.

1782.—[4855]. Dab (in Hindústání "kúsh") grass (*Eragrostis cynosuroides, Poa cynosuroides*, L). Lahore. Shahdara.

Also from the Salt Range (4930), and Gugaira (4937).

This is the "kusha" or "darbha" grass, so sacred in ancient Sanscrit writings. Sir W. Jones quotes the Veda. "Thee, O *Darbha*, the learned proclaim to be a divinity not subject to age or death. Thee they call the armour of *Indra*, the preserver of regions, the destroyer of enemies: a gem that gives increase to the field. At the time when ocean resounded, the clouds murmured and lightnings flashed, then was *Darbha* produced, pure as a drop of fine gold."

1783.—Dib grass; in Punjabí, khabbal. Creeping Cynodon (*Cynodon dactylum*). (Dúrvá of Sanscrit). Lahore.

This is the common creeping grass which is usually collected for horses by the grass-cutters, and is said to be the best kind of grazing grass. The flowers of this plant present a most beautiful object when examined by the microscope. It is mentioned in the "Atharvan Veda," as the plant with a hundred roots, and a hundred stems.

The following kinds of grass should be distinguished.

1. Dáb, or dabhah (*Anatherium muricatum*).
2. Dab, or kusha (*Eragrostis cynosuroides*).
3. Dub, or khabal (Punjabí), (*Cynodon dactylus*).
4. Dib (*Typha angustifolia*).

1784.—[4875]. Kahi grass. Lahore jungles. Imam Baksh.

1785.—[4856.]. Ser grass (*Imperata Kœnigii*). Banks of the Rávi, Lahore. Imam Baksh.

1786.—[4869]. Mandal straw rope. (*Eleusyne coracana*).

The straw of this crop is flat and excessively tough, so much so that in gathering the crops the heads are pulled off by hand, leaving the whole straw standing.

1787.—[4870]. Rice straw rope, "parálé" (straw of *Oryza sativa*). Lahore. Imam Baksh.

1788.—[4873]. Wheat straw rope, "Itar gandam" (*Triticum æstivum*). Lahore. Imam Baksh.

III. FIBROUS MATERIALS FOR PAPER-MAKING.

The number of substances that might readily be turned to account for this purpose is immense. Many a plant would yield a fibrous pulp quite suitable for paper, though

Muzuffarábád too low for the *Parrotia*, there are jhúlas of ropes made of raw hides. These bridges are truly suspension bridges: 2 or 3 ropes placed side by side form the footing, and above these 2 ropes, one placed one on either side to hold on to; thus a triangle would be formed if a section were made. To keep these ropes in place, ropes are passed round, like a rude balustrade. To prevent the ropes collapsing, cross sticks are inserted at intervals. Only on the Kishnganga river these cross sticks are obviated, by the use of sticks shaped like the letter V, which of course keep the three ropes (the lower and two upper ones) in their place without any horizontal or transverse sticks.

it might not be equal to the strength of a rope, or the eveness of a textile fibre.

At the sametime the refuse (tow, codilla, &c.) of all kinds of superior fibres will yield a paper-making material.

1789.—[4913]. Plantain fibres used in the manufacture of paper. Gujrat Jail. LOCAL COMMITTEE.

(For particular accounts of Paper Fibres and their Manufacture, reference should be made to Vol. II., under the head of Fibrous Manufactures).

1790.—[4914]. Fibrous root of the chichira—dhák or palás (*Butea frondosa*), used in making paper. Gujrát Jail.

1791.—[4786]. Kanera bark fibre (*Daphne oleoides*) called Kuttilál in Hazára, &c.

This grows abundantly in many of the in-montane valleys. The bark is stripped off, and the inner layer of fine bark yields a material suitable to paper-making, like the other species (and a *Desmodium*) which follow.

1792.—[4786]. Niggí (*Daphne cannabina*). Syn.—Jeku (Basáhir); niggi (Kúlú); sannarkat (Kashmír).

It grows in the hills, from 5,000 to 8,000 feet. The following extract from an account of Hill products, published in one of the Select Correspondences, describes the production and uses of the *Daphne*.

"8th May. China to Kishang. — The road lay through a forest of *Cedrus deodara* and *Pinus gerardiana*, with numerous bushes of *Daphne macronata?* of ROYLE, known as 'jeku' in the valley of the Sutlej, a pretty shrub with white flowers, 3 to 5 feet high, with smooth upright pliant branches. The fibrous bark is used in the same way as that of *D. papyracea* in Nepaul, and is regularly exported to Sungnum, Shipki, and Ladákh, for the purpose of paper manufacture. In the course of three days I met nine men laden with the bleached bark, neatly tied in small bundles; the fibre being light, 24 bundles 2 feet long and 3 inches thick, forms a man's load. They were all hill men, returning from Rampore to their homes on the frontier, where the *Daphne* is not found.

"With much difficulty I ascertained some particulars of the process of paper manufacture at Sungnum, which we did not visit. It is somewhat as follows, and resembles the obsolete fashion of paper-making by hand in England. Having brought the bark of 'jeku,' from the jungle, it is left in water for one day. The inner layer is then easily separated by hand, and after being dried, the raw material is carried up the valley on men's backs, as above-noted. It is again steeped in water, through which wood-ashes (walnut) are diffused, and heat is applied till the bark becomes soft and white. It is then removed and beaten with a mallet till it assumes the form of pulp, which is stirred round in a tub, and afterwards allowed to deposit on a cloth sieve or frame, one yard wide, which is finally put out to dry in the sun.

This *Daphne* is abundant on the Sutlej (upper and lower Kunáwar), and also in the valleys of the Pábar and Tonse, at an elevation of 4,000 to 7,000 feet. It is particularly abundant near Pangi, one stage beyond Chini and from Miru to Wanghtu, preferring exposed cliffs where little else will grow.

"The fibre of the bark, like that of its congeners, possesses great tenacity and makes strong ropes, which are used in Garhwal, &c. A soft, smooth and toughish paper is manufactured by the process detailed above, and is the only kind procurable in Ladákh and on the frontier. * * * * * *

The better kinds are extremely strong, and are used for important documents, being durable and resisting the attacks of the fish insect (so called), hence this paper is well suited for public records and Herbaria. The process of making paper in Nepaul from *Daphne papyracea* (*cannabina*) is described in the Asiatic Researches (Vol. XV.) by DR. WALLICH, who figured the plants.* DR. HOOKER states the paper in Thibet is made chiefly from the bark of *Edgeworthia Gardneri*, and is imported from Nepal and Bhutan. In the same manner Ladákh is supplied from Kunáwar.

At Dhurmsalla Jail an allied species, "kanera," (*Daphne oleoides*) is used, and the paper prepared is of fair quality. The shrub grows about 3 kos from the station, and the supply has fallen short; and, consequently, the district court and kutcherry are only partially supplied at present with the *Daphne* paper, the fibre of which is supplemented by the use of "tát." The paper made at jail is sold at forty large sheets per rupee.

It is doubtful whether any material for paper-making could be exported profitably from the Punjab to England, the distance from the sea-board being so great: but the inner layer of the bark separates easily, and the paper made from it so nearly resembles cartridge paper (being strong and tough and not cracking or giving way when folded or rubbed) that it might be advisable to send a shipment to England of the

* See also Vol. II. of this work, under "Paper."

fibre of each species (say 1 ton of each) for trial and report. It will be remembered that the specimens showing the various stages of manufacture of the Nepal paper shrub (*D. papyracea*) attracted particular attention at the Kew Museum, and at the International Exhibition in London, 1862.

Of the uses of this plant good accounts have been given by MR. HODGSON (Journal Asiatic Society, I., page 8, 1832) and DR. CAMPBELL. The former describes the process as consisting, first, in boiling slips of the inner bark of the paper plant in a ley of wood ashes for about half an hour, by which time the slips will be quite soft. These are then beaten in a stone mortar with a wooden mallet till they are reduced to a homogeneous pulp. This is then diffused through water, and taken up in sieves and paper frames, as in the ordinary process for making paper by hand. When dry, the sheet of paper is folded up; sometimes it is smoothed and polished by being rubbed on wood with the convex side of a conch shell; but MR. HODGSON does not explain how the very large sheets of several yards square are made. Though called Nepalese, the paper is not manufactured in Nepal, but in Cis-Himálayan Bhote, in the midst of its immense forests, where there is an abundant supply of the plant, of wood for ashes and for firewood, as well as a constant supply of clean water. This paper is remarkable for its toughness, as well as its smoothness. Some of it, in the form of bricks of half-stuff, was sent to this country previous to the year 1829. As the quantity sent was not sufficient for a complete experiment, a small portion of it was made into paper by hand. An engraver, to whom it was given for trial, stated that "it affords finer impressions than any English-made paper, and nearly as good as the fine Chinese paper which is employed for what are called India paper proofs." (Gleanings in Science, I., p. 210). DR. CAMPBELL describes the paper, as made by the Bhoteahs, "as strong and durable as leather almost, and quite smooth enough to write on; and for office records, incomparably better than any India paper.

"It is occasionally poisoned by being washed with preparations of arsenic, in order to prevent the destruction caused by insects. Many of the books in Nepal, written on this paper, are said to be of considerable age, and that the art of making paper seems to have been introduced about 500 years ago from China, and not from India." He states, "that this paper may easily be procured at Patna, Purreah, and other places in the plains of both Southern and North-Western India."

1793.—[4787]. *Desmodium tiliæfolium.* Kangra Hills.

A pretty *Leguminous* shrub, with clusters of pale lilac flowers: the bark is used for paper-making (see *Plate*).

1794.—[4784]. Birch bark (*Betula bhojputra*). Kangra.

This thin white bark occurs in sheets or pieces which can be peeled off: it is used to made umbrellas, and said to be used for writing on. I have often received articles at druggists' shops wrapped up in birch bark, just as the leaves of the "palás" are used. Its chief value in native manufacture is the making of the snake or flexible huka pipes (necha pechwán), these consist of coils of iron wire wrapped over with birch bark, and then covered outside with silk, and ornamented.

The *Betula bhojpatra* grows at elevations of 9000 feet.

1795.—Leaves of *Zea mays* (maize); jawár (*Holcus sorghum*), &c.

The value of these as a paper fibre is illustrated in an extract from the "Times," *September 13th*, 1865.

The uses of Maize.—A hint to India. "The Austrian department of the International Exhibition has received very recently a most interesting augmentation in a collection of the products made from the leaves of the maize plant. This collection shows the head leaves of the plant, which hitherto had no useful application except as fuel or litter for cattle. These leaves, however, are capable of yielding a nutritive substance, or breadstuff, for human food; a fibrous material capable of being spun and woven like flax, and ultimately, a pulp from which a most beautiful paper can be produced. The collection shows maize fibres prepared and spun into yarn, some woven fabrics made of the same, and all kinds of paper produced from the leaves of this plant. The most important question as regards the practical utility of an invention of this kind is the commercial gain that can be derived from its application. The results of the experience gained till now are very satisfactory as to this point. The whole mass of the head leaves yields on an average one-third of its substance for spinning, one-third for paper, and one-third for food; waste there is nearly none. The whole of the fibrous substance may also be worked up into paper. The process as carried on in the Imperial Paper Manufactory at Schloegelmuehle, Lower Austria, gives a produce of 100 lbs. of paper from 300, lbs. to 350 lbs. of head leaves, irrespective of the other materials, and 1 cwt. of such leaves costs only 6*s.* when delivered at the paper factory. To produce the same quantity of paper about 160 lbs. of rags would be required. According to official returns there are 35,000,000

acres of land in Austria planted with maize, the annual product of head leaves from which is estimated at 2,750,000 cwts. If the whole of this is worked up into paper the yield would be enormous, exceeding 1,500,000 lbs. annually. So strong and durable is maize paper that if ground short it is even said it can be used as an excellent substitute for glass, so great is its natural transparency and firmness."

IV. SUBSTANCES USED IN MATTING AND THATCHING, &c.

1796.—[4926]. Fibrous leaf of date palm (*Elate silvestris* or *Phœnix silvestris*). Shahpúr (Khúshab).

The material of the leaves of palms is generally too strong to admit of the separation of the individual fibres, like the agave and pine apple; but this very property, and the narrow slips in which these leaves are formed, makes them singularly suitable for mat and basket weaving. Fans and mats are abundantly made of them. The best of them, however, are from the Peshawur *Pattá*, to be noticed presently.

Samples were sent from Lahore (4857). The palm leaf is found at Lahore, but this particular sample came from Múltán.

(4942) Gurgaon.

(4958) Dera Ghází Khán, called "patís."

1797.—[4959]. Palm fibre, "khajúr múnj" (*Elate silvestris*). Dera Ghází Khán.

A sample is sent from Muzaffargarh of the fibre, or rather fibrous involucre, the reticulum of the palm, entire (4918); it is called "kabál" or "khajúr ka bokla;" it is used to make pack-saddles for oxen, or the fibre separated is made into ropes. (For an account of the growth of the date tree, *see* under "Fruits." Art. Dates.) The strips of the tough fibrous leaf, which is the subject of the last number, are called in Muzaffargarh "bútra" or "pattra." It is noted as an article of great importance and general use in the district, as also in the lower Derajàt.

A sample was sent from Delhi (4710), as "resha dirakht-i-khúrma."

1798.—[5416]. "Mazri tree" (*Chamærops Ritchiana*). Bunnoo, Shaikhbudín and Wazírí Hills (kílú and kaliún, Salt Range).

This is a fine specimen of the entire plant with its fruit or berries attached. The leaves and leaf-stalks enveloping the tree stem, yield in narrow strips, the tough fibre used for making mats, fans, and hand punkahs. The fibre is called "patha." Peshawur is the great place of production, and the imports of manufactured mats and punkahs from Peshawur to the great cities of the Punjab are very large.

The hard fruits and seeds of the tree are pierced for beads, and used by Mahommedans for rosaries.

(4927) A sample (pathá) from the Salt Range was exhibited by Dr. Henderson, where it grows on Sakesar from 2,000 to 5,000 feet.

(4966) Peshawur.

(4860) An imported sample from Lahore.

1799.—[4968]. "Lukh," a reed (*Typha sp*——?) Peshawur.

This is a reed or flag, which is much used to make floor mats, just like the matting made out of *Typha elephantina* in the plains.

THATCHING MATERIALS.

1800.—[4871]. "Sarkara" grass. Lahore. Imam Baksh.

1801.—[4929]. "Sirki" grass. Shahpúr.

1802.—[4941]. "Kánná" grass. Guguira.

(4961) Dera Ghází Khán.

These specimens are all the parts of *Saccharum moonja* before alluded to.

The 1st, *sarkara*, consists of the tufty leaves or grass of the plant, which is different from the stem leaves and sheaths (múnj), and is only gathered in bundles for thatching purposes.

Sirki is the tapering end and flower head of the flower stem after the seed has been brushed off: these slender stem tops are placed close together, and side by side, and their ends cleverly secured together, by a binding of grass rope into which they are inserted. These are used as a kind of roofing or penthouse to protect the tops of carriages and wagons during the rainy season, and for various other purposes of roofing and shelter.

Kánná or *sarkanda*, is the thick culm, used to make "chicks" and furniture, as previously described: the fine parts of the culm are called in Muzaffargarh "tilí," and the pith from inside, called "*khillu*" or "*khál*," is eaten. The tops of the grass, as soon as it flowers, are given in this district to cattle, as it is supposed to increase the supply of milk.

It may be advisable to give all the names applicable to parts of this grass, so that the reader may see the varieties of name and usage at one glance. Beginning from the root, we have

1. The tuft of grass leaves, only used for thatching = *sarkara*.

2. The fine stem leaves, and sheaths enveloping the stem = *munj*.

3. The culm = *kánná* or *sarkanda* (finest part = *tili*, Muzaffargarh). .

4. The upper end of the flower stalk after the downy flower seed is shaken off = *sirki*.

1803.—[4734].—"Khas." Ambálah district.

This is the "kuskus," or fibrous root of the *Anatherium muricatum*, used to make tatties. The root, when moistened has a pleasant fragrance; the oil of it is scented, and used in rheumatism, and a watery infusion is said to be refrigerent in fevers.

It is also much used as a packing material. The grass of the plant is called "khavi" and "panni," and the flower "izkhar." Specimens were sent from—

(4920) Jálandhar.
(4781) Kangra.
(4934) Bhera of Shapúr.
(4962) Dera Gházi Khán (banks of the Indus).

1804.—[4788]. "Hill bambú (*Arundinaria utilis*), nirgal. Kangra hills, from 5,000 to 8,000 feet. LOCAL COMMITTEE.

I have placed this last as midway between a fibrous plant and a wood for Class (F).

Not only is its wood valuable, but it affords a fibre both for rope and for paper-making. An account of it is given by BARNES in his report, as follows, and further information will be found under the head "Bamboo" in Sub-class (F), (Woods).

"The wild bamboo is found in almost all the ranges that skirt the plains. There are extensive forests in the hills of Chokee Kotlehr, conveniently situated in the neighbourhood of the river Sutlej. Merchants from Loodeeana occasionally come up and cut them, and Government exact a fee of one rupee for every thousand. It appears again, in greater profusion, in talooquas Seeba and Dutarpoor, where considerable districts covered with bamboo, have been marked off as Government preserves. In talooqua Lodwan, near Pathankote, the same plant is scattered over the forests, mixed with other trees, and a dense thicket of bamboo, almost impenetrable, clothes the southern flank of the Asapooree hill, in talooqua Rajgeeree. In the Snowy range two or three diminutive species occur. One, called 'nirgal,' is used by the people for wicker work and for lining the inside roof of their houses; another kind, called 'girch,' is in request for the sticks of hookas.

"Besides these wild varieties, there are five different sorts of cultivated bamboo. Two of these, the "muger" and the "mohr," grow in the vallies, and attain a size and height not surpassed in Bengal: the other three species, called 'nall,' 'boatloo,' and 'phugloo,' are usually found in the upland villages. In the cylinder of the 'nall,' a substance sometimes coagulated, sometimes liquid, is discovered, known in Hindostan by the name of 'bunslochun,' and highly valued for its cooling and strengthening properties.

The following samples were exhibited by DR. W. JAMESON, and are included here, as several of them are capable of production, and actually have been produced in the Punjab.

1805.—Fibre of the *Sanseviera zeylanica* (Tiliaceæ). Saháranpúr.

This is the *murva* of Bengal, and the *marúl* and *márgari* of Southern India.

The plant grows in jungly salt soil along the coast. It can be easily propagated by the slips that issue in abundance from the roots. It will grow almost anywhere, and is perennial. The leaves are from 3 to 4 feet long, and the fibre, which runs the whole length, is obtained by placing the leaves on a flat board or stone, and scraping off the pulp; after which the fibres are washed and dried, or the leaves may be steeped to decompose the cellular. This has been called by DR. ROXBURGH, "bowstring hemp" from the use it is put to in some parts of the country: the sacrificial cord of the *khsatrya* class (military) among the Hindús used to be made of this. The fibre is very strong: a line, 4 feet long bore 120 lbs., when a similar one of Russian hemp bore only 105, and the *Sanseviera* fibre after 116 days' maceration in water bore 30 lbs., when the hemp was completely rotten.

1806.—Fibre of the *Yucca gloriosa.*

These are similar to the agave fibres, and will take color well when dyed.

1807.—Fibre of *Agave cantala.*

1808.—Fibre of *A. Americana.*

These are accompanied by samples of the fibre dyed red and green, and also of a beautiful white matting made from them.

MAJOR DRURY gives the following account of *A. Americana* in his "Useful Plants."

"This is much used in the Madras Presidency. It is manufactured at a very slight expense, the mode of preparation being usually to cut the leaves and throw them into ponds for three or more days, when they are taken out, macerated and scraped with a bluntish instrument. It has been found that the leaf

fibres are liable to rot owing to a milky viscid juice contained in them. This defect has however been considerably obviated by very hard crushing, or pressure between heavy cylinders, which by getting rid of all the moisture renders them more pliable for weaving and other purposes. In Calcutta the fibres being submitted to experiments were found equal to the best Russian hemp. They are much used for lashing bales of calico. As log-lines for ships they are found to be very durable and far superior to ropes of hemp. In several experiments that have been made, especially by DRS. ROYLE and WIGHT, aloe fibre rope has been found to be more powerful than either coir, country hemp, or jute. A bundle of the agave fibre bore 270 lbs. that of Russian hemp only 160 lbs. DR. WIGHT found some cord of it bore 362 lbs. In Tinnevelly it sells for from 20 to 40 rupees the candy of 500 lbs., and at Madras for 7 rupees a maund. In 1853-54 were exported from the western coast 3,650 cwts., valued at 21,506 rupees. There is no doubt that these aloe fibres deserve more particular notice. They are admirably suited for cordage, mats, ropes, &c., and the tow might be advantageously used in the manufacture of paper. In Madras the plant is called the "peetha-kalabantha."

DR. ROYLE mentions that the hedges of the Botanical Gardens at Sahárunpúr were made of agave. It seems peculiarly suitable for this purpose. It is commonly to be seen in gardens in the Punjab, as also "yucca," and there seems no reason why the cultivation should not extend over the Punjab. Labor is cheap, and the process of obtaining the fibre from the leaves simple and inexpensive.

REPORT ON FIBRES.

CLASS IV. SUB-CLASS (E).

THE JURY CONSISTED OF THE FOLLOWING GENTLEMEN:—

MR. D. F. MACLEOD, C.B.,	MR. COATES,
MR. WIGHTMAN,	SIRDAR NIHAL SINGH,
DR. CLEGHORN,	MR. J. MACNABB,
MR. E. A. PRINSEP,	SOHAN LAL.

REPORTER—MR. C. A. D. GORDON.

[THE Report of this Jury was to have been drawn up by the late MR. C. A. D. GORDON. Owing to his lamented decease the entire report was left incomplete, and all that I have been able to recover are some notes on the various fibrous classes which had been arranged previously.

The notes contain no account whatever of cotton and flax: these I have supplied as well as possible from a few fragmentary papers. The awards of the Jury I have obtained from the official list.—P. B.]

A very large and varied collection of fibrous substances has been contributed from parts of the Punjab, the Sahárunpúr Garden, and from Dera Dhún. Many of these are known and are habitually cultivated; others are obscure, and have been brought under notice for the first time. The value of the collection is enhanced by the accompaniment of ropes, mats, paper, cordage, &c., prepared at the different jails of the province.

The classification followed by ROYLE in his standard work, "The Fibrous Plants of India," London, 1855, appears to be the simplest, and is here followed.

GRASSES.

Saccharum munja is used for making "bán" ropes, the most common cordage in the bazar. Three sorts are exhibited from the Hissar and Múltán divisions. Excellent twine is made of this fibre, and sold at 4 seers per rupee in Jhung. The upper sheath, "munj," is beaten with mallets, and twisted into excellent rope, which is used for rigging boats; it is extensively employed as a light towing-rope on all the Punjab rivers, and is in nearly as universal use as coir is on the sea board, but must be kept constantly moist, and is therefore well suited for Persian wheels and well ropes. The refuse yields a paper stuff, employed in some of the Punjab jails.

Other species of *Saccharum*, *S. officinale*, *S. sara*, and *S. spontaneum*, are used for thatching, forming chair bottoms, and yield writing pens and arrows.

"Dab or" "panni" (*Eragrostis cynosuroides*), made into ropes.

"Kaskas" (*Andropogon muricatum*), the fibrous roots, are made into tatties, which yield an agreeable odor.

"Bagar" (*Andropogon*———?), a coil of string for lacing *charpais*, is sent from Hushiyarpúr, and grass shoes from Mandi; the fibre is very durable. The bridges over the Tonse, between Simla and Mussoorie, is made of this very tenacious grass.

"Parali" (*Oryza sativa*), rice straw, and *Triticum aestivum*, wheat straw, are extensively employed by the hill tribes for snow shoes. Price 2 annas per pair.

Arundo karka, "naltúra," culms used in making baskets.

SEDGES.

"Mút" (*Carex indica*), is used to form those parts of the snow shoes in Pangi and Lahaul, which are most liable to be torn—it grows at a great altitude. *Eriophorum comosum* (babúr) is much used in the outer Himálaya for making rope.

BULRUSH.

"Dib," "ríri" (*Typha angustifolia*), or elephant grass, is used for making mats, ropes and baskets; the manufacture may be witnessed in Anarkallee bazar.

LILIACEOUS.

Of fibres derived from Liliaceous plants, there were only two exhibitors—Dr. Jameson of Sahárunpúr, and Dr. Hutchinson of Dehra Dhún—the samples are unquestionably very good, possessing cleanness, color and strength, and to both the exhibitors they may award a medal.

The plants were *Agave Americana*, *Aloe indica*, *Sanseviera zeylanica* (marúl), and other species.

Dr. Hutchinson has furnished the accompanying Memorandum describing the process adopted in the Dehra Jail, where these fibres are dyed of good colors, and serviceable door-mats and canvas are prepared from their colored fibres at very reasonable prices.

"I give you a short account of the mode of preparing the fibre. The *first leaf* of the aloe (not subjected to any preliminary retting) is passed *once* through a pair of rollers (those employed in expressing juice from sugar-cane suit very well); by this the leaf is crushed, but not so as to injure the fibre. The leaf in this state has all its vegetable matter removed by what I call a hand-stripper (my own invention); this little machine consists simply of two iron plates, the edges of which are applied accurately the one to the other. The leaf is inserted between the edges, and the upper plate being closed on the lower, the leaf is pulled through. In this way all the cellular tissue is removed, and the fibre alone remains; it requires a little washing to separate coloring matter and gummy secretions.

"The cost of the hand-stripper should not exceed from 8 annas to 1 rupee, so that it is within the reach of every native, and the rollers are in every village ready at hand. The cost of the fibre ought to be 2 annas a seer; 6 men ought easily to separate in one day 9 seers of fibre. The aloe ought to be extensively cultivated; it makes the best of hedges and its fibre for rope, matting, &c., is invaluable. If desired I will send one of my hand-strippers, the machine is so light it would cost but little to send it."

PALMS.

In the Punjab, only two palms occur—the "date of commerce," chiefly in the Múltán

division, but introduced; and the dwarf-palm in the Trans-Indus districts—both of these trees are turned to account in many ways.

Of the economic uses of the date palm in Muzaffargarh, the jury have received the following note from W. COLDSTREAM, ESQ., C.S :—

"The reticulum of this palm, called "kabál," is used for pack-saddles for oxen, and in the manufacture of ropes (kabál-ki-rassi). This rope is used for many agricultural purposes, but not usually for wells. The rope made from the fibre of the leaf, both the stalk and pinnæ, is more frequently used for well purposes. It is called "búttr," or "pattah-ki-rassi;" and of the dwarf palm, "mzáre" (*Chamærops Ritchiana*). DR. J. L. STEWART has given this information in his account of the Flora of Peshawur Valley (Journal Asiatic Society of Bengal, No. 3, for 1863). "Very large quantities of it are brought (to Peshawur) from places about four miles off (where it is gregarious and covers extensive tracts), for the manufacture of mats, ropes and sandals, &c. The mossy looking rete lying inside the base of the petiole is used as tinder, for which it answers admirably." It has been found by DR. STEWART in the Salt Range, and is abundant in the central and western portions from 2,000 feet up to 5,000 feet; it is there called patha, kalyún or kílú. DR. BELLEW, in his work on Affghánistan (page 106), says: "The delicate white embryo leaves in the centre of the plant have a sweet and astringent taste, and are in great repute, and of common use, as a domestic remedy in cases of diarrhœa and dysentery, and that where more are to be found, they are used as a purgative medicine, but chiefly for horses and cattle.

FLAX.

The cultivation of flax for the sake of its fibre in the Punjab dates from shortly after the English occupation. Formerly, indeed, the natives seem to have had some notion of the value of the fibre: but the only use they made of it was in the manufacture of a kind of twine, called "*túti*," which the inhabitants of the country about Sealkot employed in stringing their charpoys. The difficulty of the operations required in the production of good fibre, is sufficient to account for the negligence with which the natives treated this product.

The Indian Flax Company (Limited) began operations in Sealkot in 1860. The Company at present merely confines itself to preparing the fibre for export to Europe. The flax grown is raised from imported seed, and is much superior to the plant of the country. It is estimated that the fibre would sell in the English market for from £50 to £75 per ton. Every season's produce is reported to be becoming more valuable. The Company has great difficulties to contend with in importing the seed in a sound state: the long sea voyage has a most deleterious effect on it, unless the greatest precautions are taken. The plant acclimatises itself, and the Company expects this year* to have fully 1200 maunds of good acclimatised seed. The demand for fibre in Ireland is £4,000,000 annually, and seed to nearly to that amount; and the Punjab flax, already approved at home, will find a ready and remunerative market.

The samples exhibited by the Company were pronounced to be superior to those which gained the medal at the International Exhibition of 1862. The collection consisted of—

1. Newly imported Riga seed.
2. Ditto acclimatised, 2nd year.
3. Ditto ditto, 3rd year.

1. Flax straw, green, this season's growth.
2. Ditto dried, produce of imported seed.
3. Ditto produce of acclimatised seed, 2nd year.

* This was in 1864.

4. Flax straw ditto, of acclimatised seed, 3rd year.
5. Flax steeped.
6. Flax straw steeped and partly cleaned.
7. Flax cleaned, and bundled for export.
8. White flax, worth in England from £80 to £90 a ton.
9. Date flax, worth from £90 to £100.
10. Tow or refuse, worth Rs. 2 to 3 a maund, for making paper or coarse cloth.
11. A piece of linen made at Belfast with Indian flax.

[A hiatus occurs here in the remarks, which I endeavor to supply.]

The fibres in the foregoing notes are derived from plants of *endogenous* structure: the next series are of *exogenous* form.

In *endogenous* plants, the fibres of the leaves are parallel to each other, and hence can be separated for conversion into fibres, as in the leaves of the aloe; but in exogenous plants the venation is reticulated, and when these plants yield fibre, it is from the stems, where the fibres lie parallel, as inside the bark.

In annual stems, there is a central shaft of pith, and round it a layer of wood-like matter, called boon or shove, over this in fibre-yielding plants there is a layer of cellular tissue in the form of elongated cells or fibres, these are called "*bast.*" Outside is the skin or cuticle. In trees the bast is just inside the newest formed bark, such is the case with the bast or fibre of *Grewia*, *Hibiscus*, mulberry, and the roots of the "palás."

The most important of our fibres are the flax, the san *(Crotolaria juncea)*, and the "sankokra" *(Hibiscus cannabinus)*, and hemp *(Cannabis sativa)*.

The "mádar" fibre is also of great excellency, but is not in use as yet.

All these yield fibre from the stems: two others remain, cotton and the follicles of the "mádar" plant, which yield a floss, not to be confounded with the silky fibre of the stem, which is much superior to it.

An account of the progress of flax cultivation in Sealkot, and the Company's operations, has been given in detail in the preceding pages. A prize was awarded for these flaxes.

The next best fibre to flax was adjudged to be the prepared Himálayan nettle fibre; some samples were very rudely prepared however, and even the best inferior to the Ootacamund fibre, some specimens of which were exhibited for comparison: the Agri-Horticultural Society had offered a prize of Rs. 250 for a nettle fibre; a two seer sample being sent as a *boná fide* representative of a quantity of not less than 100 maunds; no competition was made, and the prize was not awarded. All the samples were small. Another fibre, much admired, was that of the "sankokra" *(Hibiscus cannabinus)*, its long glossy fibres make it very suitable for ropes, matting, &c., but its strength was somewhat inferior to "san."

The "san" (*Crotolaria juncea*) was exhibited from almost every district, and but little difference was noticeable. Some Himálayan hemp was sent: the remarkable strength of this fibre is noted by Dr. Royle. Equal weights and lengths of fibres being taken—Petersburgh clean hemp broke with 160 lbs., while Kangra hemp bore 400 lbs. without breaking.

A large number of fibres were exhibited as curiosities—the downy substance from the back of the leaves of *Onoseris lanuginosa*; the fine fibres from the stalk of the lotus and madár" floss. Among these may be also specially mentioned the variety of san, called *Crotalaria burrhea*. Although it grows in many places, it is treated as useless throughout the Western Provinces, Trans and Cis-Indus, from Peshawur to Múltán, and appears only to be used in places where the cultivated *Crotalaria* san is not much grown, as in Shahpúr, Jhung and Dera Ghází Khán. It is generally called *khip*—it gives out a strong smell when bruised—very like that of the common broom of Britain in similar circumstances: when uncropped by animals, it is a crouching half-shrubby plant of four to five feet high,

with pretty yellow flowers, and has no small branches on the upper part of its stem and branches.

The jury are glad to have it in their power to publish an illustration of this interesting plant from a sketch by W. GOLDSTREAM, ESQ., C.S.

Another species of coarse sunn is the "jhijjan."

It may be now useful to collect together in a tabular form the fibre-yielding plants of the Punjab.

The number of fibre-yielding plants found along the base of the western Himálaya is certainly not under forty species.

English or Vernacular name.	Botanical name.	Uses.
"*Khas*," "dab," "niala," "nal,"	*Andropogon schœnanthus, A. muricatum, Poa cynosuroides, Arundinaria utilis, Arundo carka,*	Used for making ropes, mats, baskets, paper, &c.
Babúr,	*Eriophorum cannabinum,*	Rope bridges of the Himálayas.
Múnja,	*Saccharum munja,*	Twine for many purposes, ropes for Persian wheels, a paper material.
Sar or sarkara,	*S. spontaneum,*	Ditto ditto.
Dib,	*Typha elephantina,*	Very extensively used for tatties and mats.
Marúl,	*Sanseviera zeylanica,*	Bowstring hemp. Rare, as are also the two following Liliaceous plants.
Great aloe,	*Agave Americana,*	
Adam's needle,	*Yucca gloriosa,*	
Plantain,	*Musa paradisiaca,*	Not abundant in the Punjab.
Dwarf palm,	*Chamærops Ritchiana,*	Shoes, ropes, matting.
Date palm,	*Phœnix silvestris,*	Ropes, matting.
Bichú, Himálayan nettle,	*Urtica heterophylla, U. reticulata,*	
Paya,	*Bohmeria nivea,*	Grass cloth of China.
Siharú,	*B. salicifolia,*	Rope.
	Forskahlia tenacissima,	
Bhang, hemp,	*Cannabis indica,*	Fibre and canvas.
Nettle tree,	*Celtis Australis,*	Well ropes and snow shoes.
Nigi,	*Daphne oleoides,*	Ropes and paper stuff.
Ak or madár,	*Calotropis gigantea,*	Fibre for textile fabrics.
Jeti,	*Marsdenia tenacissima,*	Used for string and bowstrings.
	Periploca aphylla,	Used at the Attock bridge-of-boats.
	Dæmia extensa,	
Kip,	*Leptadenia Jacquemontii,*	Yields the kib fibre of Sind: well ropes are made of it.
Kaffi,	*Onoscris lanuginosa,*	A coarse cloth is made from the woolly down covering, the under side of the leaves.
Lasúra,	*Cordia latifolia,*	Ropes.
Dák or chichra,	*Butea frondosa,*	
	Desmodium,	Paper stuff used in Tibet and Rawalpindi.
Málun,	*Bauhinia racemosa, B. Vahlii,*	Ropes and matches.
San,	*Crotalaria juncea, C. burrhea,*	Fibre ropes, gunny bags.
Kikári,	*Acacia farnesiana,*	Bark has been used as a paper stuff.
Dáman,	*Grewia oppositifolia,*	Ropes.
Alsi,	*Linum usitatissimum,*	Flax.
Kapás,	*Gossypium indicum,*	Country cotton.
	G. barbadense, G. acuminatum,	Introduced cotton from America.
Sankokra,	*Hibiscus cannabinus,*	Hemp-like *Hibiscus.*
China Rose,	*H. mutabilis,*	
Rozelle,	*H. sabdariffa,*	
Bera patua,	*Abroma augusta,*	Strong white fibre.

Of cottons there were a large number exhibited. There was native cotton cleaned and uncleaned; some of it rather good, some very bad, being mixed with bits of seed and bits of the pod or calix, which are very difficult to detach.

And next was cotton grown from acclimatized or imported seed. Several districts sent specimens of great excellence; but in the majority of them, the cotton was picked from an experimental plot in a Government Garden, or elsewhere, where it had received the utmost care: there was not a single sample which exhibited the fair results of a cultivation for a large area.

The natives are singularly unwilling to use good seed, even if it is given them: a few people have had the sense to do so, but speaking of things generally, it may be fairly stated that there is no demand for good New Orleans and other seed, and the people do not care to cultivate in the slightest degree: if they do cultivate, they cannot clean it, or make use of the cotton.

The very finest cotton was exhibited from Muzaffargarh, from the Government Garden. A prize was awarded to this.

The cottons of Jálandhar, Shahpúr, Gujrát, Sealkot, Rohtak and Deraját, deserve special mention; Sealkot, Gujrát and Rohtak, appeared to be the places were the fine cotton was produced, more as a real *crop* than a mere experimental plant.

Many of the samples of cotton were so broken in cleaning, that it was difficult to judge of their length of fibre.

CLASS IV. SUB-CLASS (F). WOODS AND TIMBERS.

Before entering on the enumeration and classification of the woods of the Punjab, it is proper to say a few words relative to the source of production of these woods. A collection of specimens may be highly interesting in a botanical point of view, and highly interesting as showing what woods are at hand for the fancy woodworker, the inlayer, and the cabinet-maker. But the main economic value of these timbers (apart from considerations of strength, durability, texture and color) will depend on the quantity in which they can be produced for buildings, for railways, and the many purposes for which timber is indispensible. Nor is the supply of timber for building and furniture-making purposes all that we have to consider. In a country destitute (or for all practical purposes, destitute) of coal, the supply of fuel, both for the manufactories of the province, its railways and steam flotillas, as well as its domestic consumption, is another important item in the consideration of our timber resources.

It will be interesting, therefore, not only to enumerate the woods that are, or may be, grown within the boundaries of the province, but to indicate in a general sketch the places of production, and the extent to which these localities are capable of yielding a supply; at the same time warning the reader that I have neither the space nor the knowledge requisite for a full account. I regret this the less, as there are before the public, reports, the result of personal and local experience and long familiarity with the subject, from which details of every kind may be gathered.*

As we have observed throughout the various classes of products, that the districts of the plains, the *sub*montane districts, and the *intra*montane districts, furnish the most distinctive characters in soil, products, language and dress, so we find it pre-eminently the case of forest produce. Our wood resources may thus be classified as—

1st. The intramontane forests, by which are meant those vast expanses of wooded hill-side and valley, to be found in the interior of the Himálaya—some within our own territory, and some beyond them. The most accessible of these are situated (up to a certain distance inland), along the valleys of the great rivers of the Punjab, the Rávi, the Beás, the Sutlej and the Chandrá Bhagá or Chenab, and the Jhilam, Indus, and Kunhár of Kághán.

2nd. Those submontane forests which clothe the sides of the lowest Hills or inferior Himálayan range fronting the plains, and skirt the bases of them; and

3rd. The wood resources of the plains—which consist—

(*a*) Of the ordinary wood growth of the country where there are "topes," clumps, and even groves of trees, but nothing like a regular forest; these are, however, as subject to conservancy rules as the regular forests are, and the resources of the country in this department are capable of extension and preservation by attention to Arboriculture.

(*b*). The jungles, "rakhs," or grazing grounds, or "thal" districts, of greater or less extent in the various districts, and some of them chiefly valuable for the grazing they yield to large herds of cattle, who pay the "tirní" or grazing tax to Government,—Others for

* *See* Dr. Cleghorn's Forest Report of 1864; The report on the Basahir Deodar Forests, by Drs. Brandis and Stewart; and the admirable reports of Dr. Stewart on the Rávi and Chenab Forests; and on the Fuel Resources of the Punjab; and the Kalesar and Kachi tracts.

the quantity of root-stocks and stunted growths of "jhand" *(Prosopis)*, ~~&c.~~ which afford for a time, at least, supplies of fuel. In this section must also be included the tracts which are now being artificially planted, and the plantations along canals and road sides.

(*c*). And, lastly, the few groves or jungles, consisting generally of aggregations of particular kinds of trees—which exist in some parts of the plains, and stand at present as the remains of forests that were once of vast extent, and if they could only be restored would be of immense value. Such ~~as~~ are the "dhák" jungles in Thanesar, which once covered a large area; the "sál" patches in Hushyarpúr, the Kalesar forest of Ambálah, and the "Kachí" forests on the banks of the Indus—and others perhaps might be added.

It will be well to take a brief survey of each of these sources of wood, before noticing the species that are produced by them.

1.—*Intramontane Forests.*—Our knowledge of these is to some extent limited: the vast net-work of mountains forming the Himálayan series, presents a surface so varied and so difficult of access, that it is impossible to lay down on a map *all* the tracts of primeval forest that may exist. Our knowledge is principally derived from the travels of those who, following the valleys of the great rivers, as inlets into the mountain fastnesses, have observed and recorded what they witnessed.

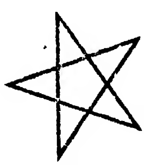
For practical purposes it is to be remembered that forests are only specially noteworthy, when they exist where there is a possibility of floating their timber on the great rivers, or their tributaries, or when very easy carriage to such places of launching is possible; hence forest observations and surveys are usually confined to the river valleys.

To attempt, in a general sketch, any description of these scenes would be impossible. But the reader interested on the subject, will find notices in Hooker's and other Himálayan Journals, in the works of Royle, Cunningham, Gerard, Hutton and Burnes; while specially devoted to the subject are portions of the various Forest Reports, which describe the aspect of the forests in the various valleys of the great rivers and other Himálayan localities. Of the whole gigantic network of mountains forming the Himálayas, a sketch of which has already been given at page 123 of this volume,—the physical features, are of course, extraordinarily varied. In many parts, for miles round, not a tree is to be seen; dreary wastes of snowy glaciers of vast dimensions, rocky peaks and tracts covered with boulders and rocky fragments, are the characteristics; in other parts we have beautifully wooded valleys, the hilly sides of which are clothed with every variety of form and tint of foliage, while in other regions we have dense forests of the stately deodar, or some of the less valuable pines, less valuable as timber, but not the less majestic in the beauty of their growth and situation.

As before remarked, however, it is not sufficient merely to have dense forests growing. In the first place, as carriage by human labor, or by cattle and carts to the plains, is quite out of the question; ~~consequently~~, these forests only can be utilized (except of course locally), which are so situated, that the trees when felled can be easily placed in the flood of a river, and so be washed down to the plains; consequently, the workable forests are situated either where a "slide," or cleared passage down the steep face of the mountain, conveys the logs, tumbling and rolling, down to the stream below; or else where there is a very easy method of conveying the logs to the water's edge. All other forests, however extensive that are situated in such places as would not admit of the removal of the timber, are practically useless. If we look at any map, such as that which accompanies Dr. Cleghorn's report, we see at once that the available forests are all marked along the hills which overhang the valleys of the various great rivers, this partly depending on the elevational limits of growth of trees.

I am speaking, of course, in this sketch, simply of the forests of the Western Himálaya, which belong to the Punjab territories.

Felling for Government commenced on the Rávi in 1861. Previous to that, and as early as 1839,* attempts were made to contract with the Chamba authorities to deliver cut wood, but these failed. Felling commenced on the Chenáb from 1854; but notwithstanding this commencement, I may observe that the system of *forest conservancy* as at present in force is of very recent establishment. In former years, indeed, the subject of Himálayan forests was not left unnoticed; in 1851, Major Longden was deputed by the Marquis of Dalhousie to explore the forests of Bushahir and Chamba, and various other travellers have made observations from time to time. But it was not till 1861, that Dr. Cleghorn was deputed to examine generally the forests of the Western Himálaya, and to institute a system of conservancy. Early in 1864, Dr. J. L. Stewart was appointed Conservator of Forests; on each of the rivers having forests, Deputy Conservators were located, who superintended the forests generally, and the cutting and sale of the timber. Under these officers again are Assistant Conservators, who have the necessary staff of officials, workmen, and "tárús," who see to the logs, and launch those that are stranded, and clear obstructions of logs which frequently occur in the narrow and more rocky parts of the river courses through the mountains. The wood floated down is ultimately formed into rafts, according to the nature of the stream, at the first practicable locality: sometimes the streams are so narrow that they can only form small rafts of these logs, called "jhúnda;" but on the great rivers, as soon as the hilly country is passed, and the river widens out, the logs are formed into huge rafts, and are thus floated down to the depôts, at Wazírabad on the Chenáb, and others. The logs are marked by being deeply cut with a hatchet, or else branded, which latter practice is becoming common in Government timber. The Government mark is the "double pentacle," on the Rávi; a double triangle on the Chenáb; J. D. on the Jhilam, &c., &c.; other traders have different marks. A whole series of these will be found delineated at page 129 of Cleghorn's report. Some traders fraudulently cut off each others marks and affix their own, so that when the logs reach the plains they may claim them: the forest officers have of course to be on the watch against such practices, as well as to increase the number of logs which reach their destination, by re-launching those that have become stranded, clearing "jams," as when a mass of logs have become entangled across stream, and so forth. Formerly the Government charged fixed rates for deodar and other timber sold at the depôts, subsequently those rates were abolished, and purchasers made their own bargains with the officer in charge. The prevent system pursued, is, that of contract or bargain, but with certain fixed *minimum* rates. These rates have recently been much raised, and very properly so, as the former rates were in some cases actually under cost price, and much below the market value. In the intramontane tracts, the state of growth and preservation is various. There are tracts which, as proved by photographs, the trees are so thick that the most unsparing denudation would be positively beneficial; while there are other tracts which are already bare, and on which the timber has been wasted in a manner that is most reprehensible. A picture of wasteful cutting is thus given in a report on the state of Busáhir, written not many years ago. Conveniently situated, with the Sutlej at hand as a means of transport, it is not surprising that the hill-sides once



* Sec. 60, Dr. Stewart's Rávi Forest Report. Supplement "Punjab Gazette," of Sept. 20th, 1866.

richly clothed with gigantic deodars should be coveted as sources of timber, to a province whose daily increasing railway and public works are perpetually raising the demand for timber. Several merchants accordingly went up, and having entered into very loose and easy arrangements with the native authorities, commenced the most wasteful cutting: trees were felled in hundreds and flung down the rocky hill side on the chance of their reaching the river below, and floating away. Much of the timber thus cut was broken and split by the rocks over which it passed in its descent, and finally it was calculated that not more than one-tenth of the timber cut ever reached the river, so that nine-tenths of magnificent deodars, were left to decay on the precipitous hill side, whence no power could recover or utilize them! This is perhaps an extreme case, but others are not wanting. In many other places devastation by fire is almost equal in its effects. In the Kághán glen forest tracts are to be met with, where 50 per cent. of the trees are scorched and burned. Some natives carelessly barked the tree, or cut into it for resin, and the next comer, lighting a fire under it and against the trunk, the tree was soon a ruin. I have seen splendid trees 25 feet or more in girth and 150 feet high, utterly hollowed out at the base by fire. But the consumption of wood, even in a legitimate method has been so great, as to cause anxiety for the future.

"There is no more momentous question in the Punjab," wrote DR. CLEGHORN, the Conservator of Forests in 1863,* "than the careful husbandry of the portions of forests which remain at the disposal of Government. They have all acquired an increased value from the advancing prosperity of the country, and the approach of railways. Heavy drains are being made upon them, and the remaining woods must be preserved and turned to account as much as possible. This can only be effected by the reservation of tracts as Government domains, and the working of mature trees by skilled persons to meet the annual demands."

When a judicious clearing is effected in some parts, it appears actually beneficial, and there are already in the ground the seeds of new forests, which only require space, light and air to induce growth. Even in Bashahir, in the forests described, COLONEL LAWRENCE writes: "Where the old trees stood, the ground when opened out to the sun and the breeze, is soon covered with innumerable seedlings;" but the time that these must take to come to the growth of timber is considerable, a forest hastily destroyed will not restore itself in a day.

It is now time very briefly to describe the characteristics of the forests tracts.

Beginning with the most eastern portion of the Punjab territories, we have the valleys of the Giri, Tonse, and Pábar rivers, which flow into the Jumna. These valleys adjoin the district Garhwal, in which deodar forests are in abundance: in the valleys themselves, there appear to be detached forests of deodar, and some of "kail" (*P. excelsa*), while lower down, there are forests of "chil" (*P. longifolia*), or "sulli" as it is called in Garhwal.

These rivers are all rapid in their course, and have rocky beds: the angles they flow in are often considerable, and they are generally practicable only for logs of sleeper or other short lengths.

The Tonse river is under the Garhwal and Dehra Dún authorities: the Pábar and the Giri run through Bashahir and Sirmúr, respectively: there is but little deodar in the upper valleys, and the streams, as before remarked, are rapid, and the volume of water scanty.

The first great river that next claims our attention, progressing westward, is the Sutlej. It is on the forests of this river, especially those of Bashahir, that the fearful waste described in the foregoing paragraphs has occurred: but besides this, the forests have been

* Financial Commissioner's Office, No. 114, 21st Nov., 1863.

considerably denuded in a more lawful manner, at any rate the forests of Suket, Mandi, Komarsen and Bhaji, which overlook the Sutlej, have been of late years cleared away within three miles of the river. The interior hills of Bashahir are still covered with the finest forests of deodars: at Nachar, in this territory, the size of the trees is immense. The photographs of MESSRS. SHEPHERD AND BOURNE has made many readers familiar with some of these trees: one great one, which divides into two trunks afterwards, is 36 feet in circumference.* Many cedars may be seen over 20 feet in girth and from 100 to 150 feet high.

The Sutlej river is very furious and has a rocky bed: but on the whole the difficulties of floating timber are not insuperable: rafts cannot be constructed above Bilâspúr. The timber depôt on this river is Rúpar, in the Ludhiana district. Accounts vary much as to the quantity of logs which are safely floated down. DR. CLEGHORN considers that one-third or one-fourth of the logs felled in the basin of the Sutlej become available for public works within 2 or 3 years after they are felled. Besides deodar, these forests contain the *Pinus excelsa* and the *Abies smithiana*, and *Picea webbiana*, the latter are not used. Oaks are also abundant, but oak logs do not readily float, and require to be lashed to other pine logs or supported by bamboos, so do not as yet pay for export by water.

There is a large feeder of the Sutlej, called the Baspa, which, up to a certain point in its course, is practicable for timber, and it seems that there is a prospect of a good supply of deodar from the forests overhanging it.

THE BEAS river rises in a sacred pool, called "Vyás Rikhi" in the Rotang pass, at the head of the Kúlú valley. The scenery of the river valley is very beautiful, and is unlike that of the Chenáb or Sutlej. "The river is fringed with trees, and studded with green islands. There is a good riding path close along the bank which does not exist upon any other river in the Punjab." The deodar forests are, however, smaller in extent than those of Bashahir, and the trees of a less size. Some deodar tracts also extend along the tributaries of the Beás, especially on the Parbati, which is the most considerable stream, being at the point of junction almost as large as the Beás itself. Besides deodar in the Upper Beás valley, "kail" (*P. excelsa*), elm, maple, oak and walnut are abundant. On the Parbati box occurs; also olive and the twisted cypress (*C. torulosa*) are found in small quantity. A large forest of "chil" is also met with lower down on the Parbati. There are many tributaries down most of which chil, oak, and also hill bamboos are procurable.

The forest revenue in Kangra and Kullú has been as follows:—

Years.	Income.	Cost of establishment.	Years.	Income.	Cost of establishment.
1858-59	4,598 6 9	84 0 0	1861-62	6,152 2 4	2,280 0 0
1859-60	6,026 0 11	84 0 0	1862-63	7,012 1 1	2,580 0 0
1860-61	5,276 6 1	1,128 0 0			

A native of Sultanpúr thus estimated to DR. CLEGHORN the cost of felling and transporting 100 deodar trees from Kúlú to the plains:—

* To any reader who wishes to study the subject of the growth of the deodar, should read the elaborate report by DRS. BRANDIS and STEWART, and CAPT. WOOD, on the Deodar Forests of Bashahir (No. 3 of the Reprints of Government of India Records, in P. W. Department, 1865.) This report also contains an excellent map, showing the forests of Bashahir and Kanawár.

		Rs.
24	Wood-cutters, at 4 annas for 8 days,	50
100	Coolies, at 4 annas for 12 days, launching logs,	300
20	Tárús* for 5 months, at 5 annas,	500
	Catching logs, at Nadaon,	100
		950
	Sundries and Contingencies,	150
		1,100

There are considerable obstacles to the transport of timber on the Beás, from the islands and shallows on which the logs are very apt to strand, but the same injury does not happen to the logs as when they strike against the rocky masses that often obstruct the bed of the Rávi.

The timber depôt of this river is at Hari-ki-ghát, where it joins the Sutlej. The river begins to rise in April and falls towards the end of August; the working season for the forests is somewhat earlier than in the Sutlej.

THE RAVI is the smallest and most rapid of the Punjab rivers. It rises in British territory, the talúka of Bara Bungáhal; its course in the hills is for 130 miles, and the average fall for this portion is 115 feet per mile. Near the head there is not much timber, a good deal having been felled in past times, and the rest consists of trees immature or inconveniently situated.

The principal tributaries are the Budhil, the Túná, the Seul and the Siáwa. On the first is situated Barmawar, at which place there are a few fine deodars. Formerly these were preserved as sacred, but now forest operations are allowed, trees being reserved near the temples.

The Seul presents great difficulties, as its feeders on which the forests occur, have all of them narrow and rocky beds: one of these, the Tisa Nullah, runs at the bottom of a narrow gorge or chasm, a section of which will be found at page 111 of DR. CLEGHORN'S Report. In 1851, MAJOR LONGDEN reported that 5,000 logs might be exported annually from the forests of this valley, but the forests are scattered and separated from each other by deep ravines. The Seul valley itself is open and highly cultivated. The Siáwa falls into the Rávi above Basauli. Deodar may be brought down from the Jammú territories; the Maharajah cuts the trees himself, each villager being required to fell one to three a man in certain localities, and as a rule only sells to merchants when the logs are in the river.

The reader who wishes to understand the whole subject of our forest arrangements with the Chamba state, and on which our Rávi and Chenáb timber operations are so much dependent, should consult DR. CLEGHORN'S Report, at p. 115, *et seq.* The Rávi and Chenáb agencies are now united. The forests on the Rávi are divided into four working districts. The whole number of available trees in the Upper Rávi was estimated at 3,900; and undersized trees, 8,500. DR. STEWART estimates† the total of first class deodars (over 6 feet in girth) still remaining on workable places, at 5,900; those on difficult ground, at 3,625; and those on such ground that without conversion on the spot removal would be impossible, at 2,900. It is evident that a considerable portion of the latter will never be available.

"The trees yield on an average four logs, each containing 25 cubic feet. The cost of

* Who are provided with mashaks or inflated skins and poles, &c., to look after the logs in the stream, clearing them off when locked together, and setting them afloat when stranded.

† *See* page 423 Supplement to "Punjab Gazette" of 20th Sept., 1866.

cutting and carriage to the river is about one rupee per log. MR. SMITHE calculates that after paying five rupees for seignorage per tree to the Rajah, and allowing for breakage, losses and sundry expenses, deodar logs may be landed at Madhopúr at 4 annas a cubic foot; but to me this seems doubtful. * * * The chief obstacle to such a rate is the heavy loss from the appropriation of timber by native merchants and others, who live by an illicit trade in wood. The Chamba forests require rest, and it would be for the interest of the Rajah to reduce the felling to an annual average of 5,000 trees, including every species of useful timber. * * * The forests, at the present rate of felling, will not yield *mature* trees for more than five years."

The duties of the Agency for the Rávi have been hitherto conducted at Madhopúr, where there are powerful saw-mills.

In 1863 the value of the timber received was Rs. 88,963.

The CHENAB is next to the Sutlej, the largest and longest of the rivers. In physical features the valley of this river resembles that of the Sutlej. Both rivers rise in arid regions, and flow between lofty ranges of mountains, generally rocky and precipitous, but often finely wooded.

The river offers remarkable facilities for the transport of timber, and above Aknúr, "tárus" are hardly needed to disengage logs.

The deodar tract in the perganah of Pangi, extends in all about 80 miles (exclusive of the deodar preserving tract below that in Kashmír territory). The deodar grows on both banks of the river, but more abundantly on the left, and the forests are more extensive and uniformly composed of deodar than those on the Rávi. In many places the trees grow close to the water.

The Pangi timber is admitted to be somewhat inferior to the Rávi. CAPTAIN (now LIEUT.-COL.) DYAS, in testing both timbers in bars of dimensions $18 \times 1\frac{1}{2} \times 1\frac{1}{2}$ inches, found the breaking weight of Chenáb deodar to be 1,348 lbs., that of Rávi 1,821; the weight in lbs. per cubic foot being 28·62 and 35·75, respectively.

The working season in this river begins about the end of April, and ceases by the middle of October, before the snow falls and the passes get closed up. The snow melts in May, and the Rávi acquires its largest volume in July and August.

The work-people are assembled by "mukadams," or mates of gangs, who receive small advances at the beginning of the season, and give security for fulfilling their engagements. All accounts are adjusted at the end of the season before leaving the forest. In 1861, the number of "tárus" employed was 850; in 1863, it was 1,897; these were divided into gangs, and distributed over 80 miles of river on both banks. The "galls" or slides* used on the Chenáb in 1862 were 53 in number. The largest number is of first class galls, where the breakage in launching is not above 5 per cent. On the Rávi the greatest number was of third glass galls, where the breakage was 15 per cent. Longer logs are brought down by this river then any other: the trees are never felled of a less growth than 9 feet.

The Pangi Agency Office for the plains was at Sealkot, but now at Wazírábad.

Besides deodar, other trees occur in this river. Up to Kylang in Lahaul the pencil cedar (*Juniperus excelsa*) is found; also at Darwas, the *Pinus gerardiana*. Besides these, walnut, ash, maple, bird cherry (*Prunus padus*), birch and elm may be mentioned. The forests cannot now supply more than 2,000 first class trees annually, although the cuttings in 1862-63, amounted to 10,000 trees.

* To convey the timber down into the water.

From this agency the number of cubic feet of wood sold to all departments amounted to 5,38,871, and during the first six months of 1863-64, it had reached 3,52,840. The rates of timber were formerly paid, and varied at from 4 cubic feet per rupee in the shortest lengths (12 feet and under) to 1·5 cubic feet per rupee for the longest, 40 to 50 feet; but these rates have recently been doubled. In 1863, there were at the beginning of the year, 19,023 logs at the depôt, 39,598 came in during the year, total 58,621; representing a value of Rs. 2,04,503.

The Jhilam. A large portion of the course of this river is through the foreign territory of Kashmír, flowing out from the valley through the Pir Panjál range, at the Baramúla pass, and first touching British territory at Pattan.

The Kashmír Government monopolizes the timber trade, and the only kind of wood (besides some chíl from the Púnch, a small tributary) sent down is the deodar, which is despatched as soon as the snow melts, and is collected and sold at Jhilam.

It is calculated that the average supply, exclusive of British timber from Kaghán, is about 2,000 logs, and some of the timber is 50 feet in length. The British forests, which can be described in connection with this river, are those of Kaghán, through which the river Nainsúkh or Kunhár passes, and the forests of Házárá, including Murree. The principal deodar tract along the Kaghán valley is on the western or left bank slope from the village Páras up to Narang, the deodars being mingled with the *P. excelsa*.* The trees are much smaller than on the great rivers. Dr. Cleghorn considers that the valley can yield as a *maximum* 1,000 trees a year. Of the seignorage, part is taken by the Sayads, or the Swatí proprietors. The Kunhár is a very difficult river for timber passage.

Major Adams, in his report (1860) on the Forests in the Hazára district, describes the transport of timber by the stream: the incidents he relates are not uncommon during the passage of mountain timber.

Speaking of the Kaghán forests, he says: "Except in the three frontier valleys the valuable timber grows in situations where the difficulty of transport renders it useless to any but the people of the country. The slopes of the Kaghán mountains from the village of Páras upwards, are covered with magnificent deodar and biar trees, and the rapid stream of the Kunhár (also called the Nainsúkh) affords, at certain seasons, the means of transporting timber to Jhilam in pieces of moderate length, the experiment has been tried with only partial success by Major Robertson. On that occasion a considerable number of logs were lost. The stream foaming between its rocky sides rushes along at an immense velocity. If a log becomes fixed among the rocks, other logs are quickly driven and piled upon it by the violence of the stream, and thus a barrier is formed which impedes the progress of the whole float, and unless the barrier is formed sufficiently near the bank to allow of men disentangling the mass, nothing but a rise of the river will avail to set the mass in motion again."

The results of Major Robertson's attempts were, that 1,800 logs were put into the river—150 passed Balakót and 900 were landed at Dangalli: the remaining 600 having been appropriated as waif timber by the Maharaja of Kashmir. The snow on the Kaghán heights melts in March, and the river acquires volume in April: the full flood lasts from May till July.

Besides deodar, biár (*P. excelsa*), chíl, ash, olive, hazel, walnut, maple, and hill tún are procurable.

* It is remarkable both on the upper parts of this river and the Kishnganga that the deodar, which begins to be here out of its proper latitude, prefers the sunny side of the glen, unlike its habit on the rivers eastward.

The Hazára forests should more properly come in with the second class of forests sub-montane, or situated in the lower hills; but geographically being connected with Kaghán it seems advisable to place a notice of the produce consecutively with that of Kaghán. These forests have not yet been brought regularly under forest management, as the forests on the great rivers have.*

MAJOR ADAMS, in his last report, wrote as follows:—

"Direct supervision is now exercised only over those tracts which are valuable, because they produce superior timber or offer facilities for its transport to the markets. For the protection of the more inaccessable and less valuable forests, the land-owners and chiefs had been made responsible. During 1859 tax was paid on 1,422 trees, during 1860 on 3,564: one-half the whole amount realized has been paid to the land-owners. In 1860 the trees taxed were as follows:—

"Deodar (*Cedrus deodara*), ...	1,193	Kangar (*Pistacia integerrima*), ..	4
Biár (*Pinus excelsa*), ...	918	Various kinds, ...	1,133
Chír (*Pinus longifolia*), ...	188		
Walnut, ...	21	Total, ...	3,564"
Wild olive,†	107		

The most valuable forests are those on the range extending from Mochpúrah to the Chumla Peak in the ilakas of Tunnah, Nara and Bakot. Next to these comes the forests of the Thandianí, Dunna and Bírangallí ranges, including Maira, Namli and Phulkot. The forest of Tarnawáí, though little resorted to, owing to the want of the means of transport, abounds with magnificient "biár" and oak, and could perhaps be opened up at little cost. The forests of Nurhhúr, Khanpúr, Sherawán and Márí produce chiefly "chír," and are of less importance.

There is one advantage, in an economic point of view, connected with the forests of the lower ranges, that should not be passed over. I allude to the increasing value which small growth, branches, and thinnings have, where carriage is easy and the distance short; in the great interior forests, it does not pay to take anything but huge logs,—the massive trunks of the timber felled, the branches lopped off, and all the slender growth, are of necessity abandoned to waste. It is not the case with the lower forests, and such thinnings and branches are sold as fire-wood, and to the charcoal burner, while the leafy boughs of some trees are valuable enough as cattle fodder.

At Murree Sanatarium the forests are all preserved, and the Assistant Commissioner has an establishment to look after them. The rules about cutting will be found in DR. CLEGHORN's report, at page 200. Around Murree the *Picea Webbiana* and the *Pinus excelsa* are abundant; as also maple, and various other woods of smaller size. The best of these Hazára and Rawalpindi forests are to be put in charge of the Forest Department.

The last of the Punjab rivers to be mentioned is the Indus, and its tributaries, the Swat and Kábul rivers. All the forests on the Upper Indus are beyond our control, and even inspection: a few scattered notices are here and there to be found in works such as BURNES' Kábul, &c.

"The valley was once famous for timber, from the days of ALEXANDER till within twenty-

* They will be, however, immediately. Government has already taken up the felling in the Kaghán glen. A Special Assistant Conservator is on the spot.

† I believe this is "bankau" (not "wild olive," which the words *might* mean, but an oak, the identification has not yet been satisfactorily made).

Abstract Produce of the Hazara Forests.

Years.	Diar.	Biar.	Cheel. Trees.	Cheel. Saplings.	Ash.	Toon.	Kangar.	Walnut.	Drawi.	Daman.	Barungi.	Mulberry.	Paludar (*Picea Webbiana.*)	Horse-chestnut.	Phulah.	Binj.	Kau, olive.	Limi.	Kahi.	Kandar.	Birmi.	Amlok.	Bhalkarir.	Bankau.	Kalakat.	Sirin.	Willow.	Palach.	Establishment.	Fines.	Receipts.	Expenditure.	Profit.	Number of trees cut.
1865-66, ..	55	1,354	746	113	15	...	3	16	27	..	2	1	225	45	187	70	254	81	208	240	84	6	67	836	1,100	61	284	33	1,392	292	5,074	1,459	3,614	6,107
1864-65, ..	2,411	1,115	716	9	18	3	1	13	5	..	112	4	697	78	8	38	38	17	156	..	561	6	141	862	3,659	33	10	15	1,090	742	8,973	1,118	7,855	10,726
1863-64, ..	127	721	346	..	10	1	..	2	2	..	12	6	50	40	2	5	71	6	33	..	22	15	101	433	38	16	2	5	936	263	3,408	938	2,470	2,061
1862-63, ..	1,758	866	406	16	7	..	3	29	10	4	1	..	13	24	4	1	118	8	28	..	7	7	194	345	10	37	..	..	935	122	5,665	950	4,715	4,107
1861-62 (4 months),	1,024	204	107	24	..	..	2	..	1	..	..	..	2	5	4	2	1	..	250	..	..	..	7	1	..	..	..	..	312	5	1,346	322	1,024	1,634
1861. ..	1,622	848	132	..	3	...	4	..	..	..	3	..	..	36	2	..	199	..	..	..	..	3	2,530						700	185	2,106	743	1,363	5,373
1860, ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	552	343	1,443	550	793	3,564
1859, ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	564	153	1,009	564	445	1,760
1858, ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	837	..	641	975	..	..
Grand Total, ..	6,997	5,048	2,453	162	53	4	13	60	51	4	127	11	987	228	127	116	672	112	675	240	674	37	..	..	..	..	..	..	7,318	..	29,665	7,619	..	..

two years of the present date. Forests of sissoo extended on either side of the river, and on the numerous islands from Torbela to Attock. These were wastefully felled during the Sikh rule, and the remaining trees bordering its banks were swept away in the terrible flood of 1841."*

The difficulties of the timber trade consist in the varied interests and savage habits of the wild tribes which occupy the territories on either side: beyond Amb, for instance, no native of the plains can go: but the Shaikzadas of Ziyarat, from the sanctity with which popular superstition invests them can go up and get wood: they have to pass various independent Pathán Settlements, which lie between Derband and the forests. The timber is floated down to Derband, where it is stopped, and a toll levied of 8 annas a log. Merchants come up here and purchase the wood, which they take on in rafts.

The Swat river has been described from the narrative of a native by CAPTAIN RAVERTY:† The lower hills are covered with grass, but there are no forests, the higher ranges have deodar, the edible pine, olive and plane. "The timber trade," says DR. CLEGHORN, "on this river appears to be nearly monopolized by Papa Mea, head of the Kákhakhel Sayads. His people (also are very sacred) go where they please up the three rivers. He has a large depôt at Hashtnagar, in British territory, near the confluence of the Swat and Kábul rivers."

It appears that the "Akhúnd" has interfered to induce "the faithful" to abstain from the wood trade, because it benefited only the infidels, and led to quarrelling among themselves.

At present wood is felled at *Tal Patrak*, a district of Bajáwar, under Ghazan Khán of Dír.‡

Timber that reaches Peshawur is mostly brought down from the Kábul river, and its affluent the Kuner or Kaure. The lower part of the Kábul valley towards Khaibar is woodless; but above Jalálábád, there are pines and conifers in abundance. There are also "balút" (*Quercus ilex*) and olive available; also *P. gerardiana* and *A. smithiana*. The lawlessness of the inhabitants makes exploration in these tracts next to impossible. Our information is principally derived from the notes of GRIFFITHS, who accompanied the army in 1838-39, from Sindh through Quetta and Kandahár to Ghazni and Kábul.

Large wood is only brought down the rivers by special demand; lengths of 28 and 30 feet have been obtained.

THE SECOND CLASS OF FOREST LANDS are the hill sides of the inferior Himálaya, where access to the plains is comparatively much easier. To this class may be referred the forests skirting the Sirmúr and Simla territory on the lower hills, the forests bordering on the Hushyarpúr districts, such as those of Lohárá, Nairí, &c., in Kangra of Jasrota, and other forests throughout the district, and thence onward along the inferior range of the Himálaya, where there are at intervals forest tracts of greater or less extent and value, which are in the foreign territories of Chamba and Jammú. The forests of this series end, as far as territorial distinctions are concerned, with the forests of Hazára (the north-western angle of the province), a district which is enclosed, or nearly so, by the outer range of hills, is actually full of hills more or less covered with forest.

But although we have this very submontane wooded localities, it is only here and there that they constitute anything like a forest, as before mentioned.

In describing the geography of the Himálaya, the regular succession of Siwáliks,—forest

* For a graphic account of this flood, see Journal Hort. Society, XVII., 230.

† A. Soc. 1862, p. 227. I take the quotation from DR. CLEGHORN's Report.

‡ This is from DR. BELLEW, quoted by CLEGHORN at p. 212.

tract, tarai, &c., which forms so conspicuous a feature of the Central and Eastern Himálaya, is quite wanting in our Punjab Western Himálaya. The only submontane districts that can be here described as containing forest, are Házárá, which I have already alluded to, Rawalpindi, Kangra, Hushyarpúr, and part of Ambálah at Kalesar.

Following the same plan as when delineating the forests on the great rivers, I begin at the most eastern portion of the Punjab territories. The finest submontane forest tract that demands our attention is the remnant of a once far more extensive tract of "sál" at Kalesar, in the Ambálah district. This tract has been visited by Dr. J. L. Stewart, and minutely reported on by him. As the report (which appeared in the "Punjab Gazette") may not be accessible to all, I will present a brief outline of the leading characteristics.

"The forest is on the extreme north-east corner of the district, in a fork of the Siwáliks, on the right bank of the Jumna, opposite the Khárá head of the Eastern Jumna Canal, and about 3 miles above the head of the Western Jumna Canal at Haturkhúnd. The bay between the northern and southern branches of the Siwáliks in which the forest lies, is bounded on the east by the Jumna. Beyond the northern fork lies the Kyárda Dún, belonging to Náhun (the water-shed of that fork being the boundary), while to the south of the southern branch stretches the open plain of the Ambálah district.

"The extreme length of this bay from the Jumna on the east, to the angle where the two forks unite on the west, is about 13 miles, and its breadth about from one to two miles. The whole area is 14,553 acres, of which at the time of settlement (1855 ?) there were 576 cultivated. The cultivated area had in 1863 decreased to 189 acres, owing to depopulation caused by famine and sickness."

This tract seems to have been leased out for several years to a Eurasian, who cut and cleared off a great deal more wood than was proper. At last, in 1857, the lease was cancelled and cutting green wood prohibited. In the course of 1863, 2,664 acres were demarcated, as belonging to the village Kalesar, and 11,889 acres as forest land, the forest tract is divided into two unequal portions by a dry water-course. To the south of this, the "sál" is scattered in clumps and patches mixed with other trees. On the southern side and up to the southern enclosing ridge, the forest is more compact, and consists of small "sál" trees covering from 4,500 to 5,000 acres. The trees are small, and very few being 3 feet and even 4 feet in girth; the greater number are mere saplings. The estimated number of trees is about 16,50,000 in the compact portion, and 35,00,000 in the scattered tract.

The forest might be cut considerable for ballis or poles for roofing and other purposes: like many tracts of this description the forest is malarious.

The other trees are as follows:—I mention these because it will show what trees are found in this portion of the Punjab as distinct from the west.

Máljan, elephant creeper (*Bauhinia racemosa*).

Chāl (*Conocarpus latifolia*): this tree yields a gum.

Sain (*Pentaptera tomentosa*).

Bahera (*Terminalia belerica*), (a few large trees).

Kaim (*Nauclea parviflora*), a few; and only one of *N. cordifolia* (haldu) was seen, though the tree is abundant to the east of the Jumna.

Sandan (*Ougeinia dalbergoides*).

Gausam (*Sleichera trijuga*).

Tendu (*Diospyros tomentosa*).

In the Kangra district the lower hills are well wooded; and both in this district and

Hushyarpúr, there are occasional tracts, or more correctly speaking, clumps, of "sál" (*Shorea robusta*).

With regard to the patches of "sál" in Kangra and Hushyarpúr, writes Dr. Cleghorn,* it may be mentioned as an interesting fact in botanical geography that the tree here attains its western limit, and has not been seen across the Rávi. The clumps of indigenous growth at Andreta in Kangra, and Rajaura in Hushyarpúr, with perhaps others, should be preserved with the greatest care. The known forests of Kangra and Hushyarpúr are principally of "chíl," which is used in quantities for charcoal and also cut for poles. In Kangra, at most accessible places, the "chíl" has been greatly cut away; but besides "chíl" there are a great variety of other trees; some of which may be mentioned in the following list. (Proceedings of Forest Department, February 1867, from Commissioner Jálandhar, No. 173, 25th October, 1864).

The Commissioner writes:—

"I have been engaged for some time past in an attempt to classify the several trees which are to be found in the Kangra district. I have divided them into three classes—A, B, C, and these again into other sub-divisions. Those in class A are considered best for building and have the highest commercial value; in class B are those which are of less value; and in class C, shrubs and trees have been entered which are of little use except for fuel."

Class A.†

Akhrot, walnut (*Juglans regia*).—This is not a forest tree, but cultivated by zemindars on their own estates. The trunk of a very old tree is about from 15 to 18 feet; wood hard, light and strong, of a dark brown color, beautifully veined, and receives a high polish; used principally for cabinet-making purposes and for gun-stocks; not subject to worms, nor liable to warp; a good timber tree, and bears a fruit in much esteem.—Balfour, *page* 138.

Amb, mango (*Mangifera indica*).—This tree attains its full size in 60 years, when it yields good timber; the length of trunk to the first branch 10 feet, and girth 6 or 7 feet.‡ Its wood is of a whitish color, soft and light, subject to worms, and decays if exposed to water. The tree bears fruit in 8 or 10 years, and the fruit is much prized.—*Mentioned at page* 160 *of* Balfour; *and page* 34 *of Roorkee Proceeding Papers on Gwalior Timber.*

Bán, oak (*Quercus incana*).—This tree attains its full size in 100 years, and a very old tree yields a log or trunk to first branch from 16 to 20 feet in length (?), and 6 feet in circumference; wood is of a red color, hard, tough and heavy, coarse grained, liable to warp and to decay if exposed to wet; useful for building purposes; leaves given as fodder to cattle.—Balfour, *page* 205; *and* Mr. Barnes' *Kangra Settlement Report, para.* 147.

Banní.—Resembles the bán, except that the wood is of a white color, but it is applied to the same purposes as the bán. It is also a smaller tree.

Chamba.—This seems identical with the *Michelia champaca, in* Balfour, *page* 186. It is mentioned in *para.* 153 *of* Mr. Barnes' *Kangra Settlement Report.* It attains full growth

* Letter to the Financial Commissioner, November 1863.

† This list has been slightly corrected from the original, according to notes made by Dr. Stewart.—B. P.

‡ This would be a very large tree.

in about 40 years (some say 25), when it is useful for timber. Average length of trunk 20 feet, and average circumference 6 feet; grows straight, and has a yellow sweet-scented flower, the seeds of which, being also fragrant and oily, are bruised and rubbed over the body as a perfume. The wood of the tree is fine grained, of a yellow color, hard, of moderate gravity, not subject to worms, nor liable to warp; yields good timber. The flowers are offered at the shrines of the Hindú divinities.

Chál *(Canocarpus latifolia).*—The same as the "chitta" or white dhaon; wood white, hard, tough, liable to bend; yields small timber fit only for zemindars' houses; held in great request for ploughs, on account of its durability. Leaves used for dyeing leather. The gum from the tree is extensively employed in printing on cloth: the leaves of this tree are long and narrow, and the color of the fruit when ripe is yellowish; the bark is white.

Chíl *(Pinus longifolia).*—Attains full size in 80 years; grows to a great height; the trunk to the first branch being 20 feet, and girth 8 feet. Its wood is light yellow, easily worked, and light; used for timber for building purposes and for boats. The resin called "ganda baroza" or "khardalla," exudes from this tree, and is used for coating timber to prevent decay from the action of water, and also as a medicine; it also forms a material in the manufacture of glass bangles or rings worn by native women. The heart wood, which is very oily is used for making torches.—BALFOUR, *page* 189; MR. BARNES' *Kangra Settlement Report, para.* 143.

Chirndú or darindhú *(Elæodendron dichotomum ?).*—A small tree; wood white, soft and brittle; used for fuel and the small wood-work in zemindars' houses.

Chilla *(Cascaria tomentosa.)*—A small tree; wood white, soft and brittle; used by zemindars in the small wood-work of their houses. Bears a yellow bitter fruit, the seed of which is used to poison fish.

Dhaoń *(Grislea tomentosa).*—There are two species of this tree, the white and the black, distinguished by the color of the bark and fruit and the shape of the leaves. The bark of this tree is black, the color of the fruit when ripe is black, and the leaves are round like those of the "shíshám. Its wood is light yellow, hard, smooth and tough; yields good material for ploughs, attains its full size in about 30 years. The length of trunk 4 feet to 7 feet, and girth 3 feet. Is a smaller tree than the white dhaon or "chál."

Devidyár *(Cupressus torulosa).*—Rare—found in Kúlú and elsewhere. Attains a considerable height. Its wood is white, strong, scented, fine grained, heavy and well adapted for for building purposes. The wood being rubbed on a stone with a little water, forms a paste, which is applied to the temples as a remedy for headache. This tree is mentioned *in para.* 146 *of* MR. BARNES' *Kangra Settlement Report; and at page* 93 *of* BALFOUR.

Dódan, rheta (*Sapindus detergens).*—This is the soap-berry tree; attains a height of 20 feet, with a circumference of 4 feet; wood white, soft, weak and used for no purpose. The rheta or soap nut is in great request, as it is used for washing the head and for cleaning woollen stuffs.—BALFOUR, *page* 214.

Dúr *(Cedrela serrata ?).*—Wood light, soft and white; yields all necessary timber for building purposes; but is liable to warp, and decays fast if exposed to water.

Gúń, horse chestnut (*Pavia indica*).—Grows to a very great size and strength; wood soft and strong, of a white color, veined, fine grained; polishes well; used for building and cabinet-making purposes.—BALFOUR, *page* 185.

Harar or har (*Terminalia chebula*).—Grows to a fair height, the length of trunk being 10 feet, and circumference 6 feet; wood hard, heavy, of a yellowish color; used for agricultural implements, but not for building purposes. Attains full size in 30 years. In

9 or 10 years it bears fruit which sells at a high price, and is much used medicinally as a tonic; it is also used for dyeing.—BALFOUR, *page* 250; *and* MR. BARNES' *Kangra Settlement Report, para.* 150.

Jáman (*Sizygium jambolanum*).—This tree attains a good size, the length of trunk to first branch being 10 feet, and the circumference 6 feet. It attains full size in 40 years; wood hard and brittle, heart-wood tough, of a dark red color, liable to warp a little; not subject to worms; used by zemindars for agricultnral implements, and produces good timber. There is another species resembling this tree, called "kathamman," a smaller tree bearing smaller fruit, and shorter leaves.—BALFOUR, *page* 113; *Roorkee Proceeding Papers on Gwalior Timber, page* 32.

Kail or kalai (*Pinus excelsa*).—*Mentioned at page* 189 *of* BALFOUR; *and in para.* 146 *of* MR. BARNES' *Kangra Settlement Report.*

Khair (*Acacia catechu*).—Attains full size in 50 years; length of trunk 8 feet, and circumference 3 feet. A small tree, wood of a deep red color, heavy, close-grained, brittle, strong; polishes well; resists attack of insects; used by zemindars for agricultural implements, for which it is excellently adapted, such as the shafts of the plough, cotton machines, sugar-mills and pestles for husking grain. The wood of full-sized tree yields good but small timber for building purposes. The catechu or kath is extracted from heart-wood of ripe trees.—MR. BARNES' *Kangra Seltlement Report, para.* 152; BALFOUR, *page* 34; *and Roorkee Proceeding Papers on Gwalior Timber, page* 18.

Kiláwa (*Wrightea mollissima*).—Grows to the height of 15 feet; wood light yellow, soft and white, not very durable, fine grained; polishes well; used chiefly for combs, and also for agricultural implements.

Khareo (*Quercus semicarpifolia.*)—Wood white, and heavy; subject to insects and liable to warp: used for making charcoal, and by zemindars for ordinary house-building purposes; produces also good and large timber.—MR. BARNES' *Kangra Settlement Report, para.* 14; *and* BALFOUR, *page* 204.

Kiunú (*Diospyros tomentosa*).—Attains full size in 60 years. Length of trunk to first branch 8 or 10 feet, and girth 4 feet. A variety of the ebony; wood of young trees white, and of the old black, which is termed "abnús;" sap-wood soft; heart-wood, when it becomes black, is extremely hard; used by zemindars for ploughs, and for the wood-work of their houses. Bears an edible fruit.

Khirk (*Celtis caucasica*).—Grows to a good height; wood white, light, soft and weak; seldom used for any purpose. Insects attack it.

Kikar (*Acacia arabica*).—Attains full size in 20 years. Length of trunk to first branch 10 feet, and girth 6 feet.* A good sized tree; thorny; sap-wood white, heart-wood of a dark color, hard, strong and durable: used for carts and mills. Bark used as a dye by tanners, and spirit distillers use it for increasing the strength of liquor. The leaves are much prized by goats and sheep.—BALFOUR, *page* 25.

Knor (*Pavia indica*).—See gúi of this list.—BALFOUR, *page* 185.

Kelú (*Cedrus deodara*).—A tree of fast growth, and a native of Kúlú; but it is also found in the Boonghalla forests. Grows to a great height. Its wood is fragrant, of a reddish yellow color, highly resinous and inflammable; very durable; yields valuable timber; it is also not subject to warp. A thin oil exudes from the roots of the tree which is held in

* Trees of this size are very rare.

much esteem as a cure for sores; it is also rubbed over inflated skins to preserve them. The wood is also used for flambeaux.—*The tree is mentioned at page* 75 *and* 189 *of* BALFOUR; *and in para.* 146 *of* MR. BARNES' *Kangra Settlement Report.*

Kakar, kakar singhí, kakrú (*Pistacia integerrima*).—Found chiefly on zemindars' lands. In some localities this tree attains a great height, and has a good girth. In the Goleir ilaka it yields fine broad planks and beams from 15 to 20 feet long, the price of a full sized tree being Rs. 7 or 8. Its wood is light-red, somewhat resembling the toon, hard fine grained, veined; polishes well; is well adapted for cabinet-making purposes. The gall is used medicinally.—*Mentioned in* MR. BARNES' *Kangra Settlement Report, para.* 153—*vide* Rhus, *page* 208, BALFOUR.

Karál or kachnár (*Bauhinia variegeta*).—Grows to a good size, the trunk to the first branch being 10 or 12 feet, and girth 6 feet. Its wood is light-red, soft, subject to rapid decay and to worms; used by zemindars in the wood-work of their houses. The flowers are used as an article of food, and the leaves as fodder for cattle.

Kathamman.—A smaller species of the "jáman," from which it differs in the size and shape of its leaves and fruit. A decoction of the bark is used as gargle for sore mouths.

Karham or kadham (*Nauclea parvifolia*).—A tree of good size. Its wood is light, white and soft, not strong, and subject to worms; used by zemindars for the wood-work of their houses and for agricultural implements; leaves useful as fodder for cattle.—BALFOUR, *page* 178; *and Roorkee Proceeding Papers on Gwalior Timber, page* 30.

Lasúra (*Cordia latifolia* ?).—A tree of moderate size, the length of trunk to first branch being 10 feet, and girth 3 or 4 feet. Its wood is white and soft; is of little use except for fuel. Leaves used as fodder for cattle, and as plates or trenchers. Fruit edible and in great request. Only planted.—BALFOUR, *page* 87.

Mowa (*Bassia latifolia*).—Attains full size in 80 years. Grows to a good height, the trunk of old tree being 10 feet, and girth 6 feet. Its wood is of a cinnamon color, hard, close grained, heavy and durable; produces good timber for building purposes. An oil is expressed from the seed, which is used for lamps and in food, and also for adulterating ghí. A spirituous liquor is distilled from its flowers. Not common and only planted.—BALFOUR, *page* 45; MR. BARNES' *Kangra Settlement Report, para.* 149; *Roorkee Proceeding Papers on Gwalior Timber, page* 19.

Mandar (*Acer cultratum* and *A. sterculiaceum*).—Attains a good size. Wood white, elastic, heavy, close grained; used for ploughs, cot frames and jhampan poles.—BALFOUR, *page* 27.

Putájan (*Putranjiva Roxburghii*).—A tree of moderate size, the length of trunk to first branch 12 feet, and girth 5 feet. Wood white, hard, not very heavy, strong and durable, close grained, used for zemindars' houses and agricultural implements. Leaves used as fodder, and the fruit used by Brahmins as necklaces.

Phulahí (*Acacia modesta*).—A thorny tree, which does not grow to a very great height. Wood of the young tree white, of the old dark colored, especially the heart-wood, tough and durable; used for cart wheels and sugar mills. The branches of the tree are used for fences. Length of tree to first branch 5 feet, and girth 3 or 4 feet.

Púná (*Ehretia serrata*).—A small tree. Its wood is white, hard, heavy, strong, durable; used by zemindars for their houses and implements. Leaves given as fodder to cattle. Wood not much valued.

Padam or pajjá; cherry (*Prunus padus* or *Cerasus puddum*).—Grows to no very great height; wood reddish, soft, light, subject to worms, splits if exposed to the sun, coarse

grained; used by zemindars for ordinary house-building and for agricultural implements; bears a bitter fruit.

Raban (———— ?).—A tree of moderate size; wood white, soft, light; used by zemindars for their houses and implements. Bark used medicinally; leaves used for fodder.

Rakál (*Taxus baccata*).—Few found in Kúlú.

Sál or saral (*Shorea robusta*).—Found in the Indretta and Jaswán forests. A tree of fast growth, attaining its full size in 12 years, when it becomes useful. Grows straight, and to a fair height, length of trunk to first branch being 15 to 18 feet, and girth about 3½ feet. Its wood is light-brown, hard and brittle, of good grain and durable; used in house-building.—*Mentioned at page* 218 *of* BALFOUR; *and para.* 151 *of* MR. BARNES' *Kangra Settlement Report; page* 22 *of Roorkee Proceeding Papers on Gwalior Timber.*

Siríñ or sarés (*Acacia speciosa*).—Attains full size in 50 years; grows to a great height; length of trunk to first branch 12 feet, and girth 6 feet. Sap-wood white, and heart-wood of old trees of a dark color, heavy and strong; used as building timber, and by zemindars for mills and boats. It is considered unlucky to employ this wood in house-building.—MR. BARNES' *Kangra Settlement Report, para.* 152; BALFOUR, *page* 26; *Roorkee Proceeding Papers on Gwalior Timber, page* 27.

Shísham or tálí (*Dalbergia sissoo*).—Attains full size and becomes useful in 50 years. Trunk of the tree to the first branch 10 feet in length (some say 20 feet), and circumference 4, 5 or 6 feet; wood in old tree dark bay, veined, hard and of great durability; well adapted for all articles of furniture, and also as timber for building purposes.—*Mentioned at page* 96 *of* BALFOUR; *para.* 151 *of* MR. BARNES' *Kangra Settlement Report; and page* 30 *of Roorkee Proceeding Papers on Gwalior Timber.*

Shamshád (*Buxus sempervirens*).—A lofty tree; wood white, hard, coarse grained, sound; used by the poor in their houses, and of great commercial value. Never grows very large—not common.—BALFOUR, *page* 62.

Summa (*Glochidion sp.*—— ?).—An insignificant tree; wood worthless except for fuel. Bark used by tanners.

Sannan (*Ougeinia dalbergoides*).—The trunk of this tree to the first branch is 6 feet, and girth 2½ feet; wood in ripe trees of a dark bay, like the sissoo, hard veined, polishes well; used chiefly for cot posts and legs, also for combs, and in all small work; not liable to warp, nor subject to worms. Found in forests of slow growth; attains full size and becomes useful in 30 years.

Tún (*Cedrela toona.*)—A fast growing tree (planted on zemindars' estates) attaining size in 20 years (some say 30 years), when it becomes useful.* Length of trunk to first branch 10 feet (some say 20 feet), and girth 6 feet. Its wood is dense, red, hard, close grained, capable of high polish; not subject to worms, nor liable to warp; durable; used chiefly for cabinet-making purposes and for door leaves and frames. The flowers are used by zemindars and dyers for dyeing the light yellow color, called "basantí." In Jaswán the old trees are known to have fetched from Rs. 25 to Rs. 100 a tree.—*Mentioned at page* 74 *of* BALFOUR; *para.* 151 *of* MR. BARNES' *Kangra Settlement Report; and page* 36 *of Roorkee Proceeding Papers on Gwalior Timber.*

Tút or krún, mulberry (*Morus serrata*).—A tree of fast growth, attaining its full size in 20 years, when it becomes useful. Length of trunk to first branch 8 feet (some say 15 feet), and girth 5 feet. There are several species of this tree, of which that called the "krún,"

* May reach 4 feet girth in 20 years.

growing in the hills, is the best. The quality of this timber depends a great deal upon the locality in which it is grown; the timber of trees in the higher altitudes is good, that in the valleys is not valuable. The wood is yellow, tough, but liable to bend, and readily attacked by worms. It is used by zemindars for ordinary house-building, and for ploughs; it is also used for legs and posts of cots, troughs and toys. It bears a sweet edible fruit. The tree is not found in forests, but here and there on zemindars' estates.

Arjan (*Terminalia glabra* or *T. arjuna*).—It reaches a very large size; the length of trunk to first branch 20 feet, and girth 8 feet. Attains full size in 50 years. Sap-wood white, heart-wood dark colored, heavy, strong, splits on exposure to the sun, and liable to attack of white ants. A valuable timber tree. The bark is used as a cure for wounds and sores.

CLASS B.

Amal, or aoṅla, or ámla (*Phylanthus emblica.* The *Emblic myrobolan*).—Bears an astringent fruit, which is made into pickles and preserves; the wood is brittle, and is only used in door frames and for small "kurrees." The fruit forms one of the ingredients for making ink.—*Roorkee Proceeding Papers on Gwalior Timber, page* 32; BALFOUR, *page* 187.

Ber, jujube tree (*Zyphus, jujuba*).—Attains full size in 40 years; length of trunk to first branch 10 feet, and girth 4 or 5 feet. Bears a sweet and palatable fruit; wood pretty hard, red, strong and durable; used for agricultural implements, and is a good building timber.—*Roorkee Proceeding Papers on Gwalior Timber, page* 25; *and* BALFOUR, *page* 271.

Baherá (*Terminalia belerica*).—Grows to a great size, the length of trunk to first branch being 20 feet, and girth 6 feet; attains full size in 60 years. Has a spreading head. Its wood is light yellow, coarse grained, readily attacked by worms and white ants. Although useful as building timber, the people consider it unlucky to employ it. Fruit astringent, used medicinally, and for dyeing leather, and forms one of the ingredients for making ink. This tree is extensively cultivated for the sake of its dense foliage, as the leaves are considered the best and most nutritious of all fodder for cattle, particularly for milk cows.

Bil (*Ægle marmelos*).—Bears a fruit possessing medicinal virtue; wood white and strong, seldom used, the tree being held in veneration by Hindús, who place the leaves on the shrine of Siwa and other divinities. The pulp surrounding the seeds is used in lime cement. The tree is thorny.—BALFOUR, *pages* 28 *and* 89.

Bhúj (*Betula bhojpatra*).—A small tree; wood unsound and worthless except for fuel. The bark is used for chattas (rude umbrellas), and for covering tubes of húkas (native smoking pipes), and being of a sacred character, it is burnt on the funeral pile. Hindoo pilgrims visiting the shrine of Amrnath in Kashmír divest themselves of their ordinary clothes before entering the shrine, covering their bodies with the bhojpatra.—BALFOUR, *page* 49.

Bráh, brás (*Rhodedendron arboreum*).—Bears a bright red flower; wood soft, used for charcoal and in zemindars' buildings.

Bar or banyan tree (*Ficus indica*).—A great tree, whose branches spread out far and wide, dropping roots, which, striking into the earth, eventually become trees as large as the mother tree. The wood is chiefly used in oil presses. Bears a fig not edible.—MR. BARNES' *Kangra Settlement Report, para.* 157; BALFOUR, *page* 117.

Barthua (*Hymenodictyon excelsum?*).—A small tree. Wood white, soft and light, used by the zemindars for the small wood-work of their houses, and for yokes of ploughs, and also for scabbards of weapons; leaves used as fodder.

Dhúman or biyúl (*Grewia oppositifolia*).—Attains full size in 15 years; of a moderate size. Length of trunk to first branch being 6 feet, and girth 2 feet; wood straw-colored, soft, elastic, durable. Well adapted for handles of axes, and all other tools, for cot-frames and "bainghís" (poles used by kahárs for slinging weights to be carried). The fibre forms a rope (not strong or durable) for fastening cattle, and for other common purposes.—BALFOUR, *page* 126; MR. BARNES' *Settlement Report, para.* 15; *Roorkee Proceeding Papers on Gwalior Timber, page* 20.

Drek or bakain (*Melia azadirach*).—A tree of ordinary size. Its wood is reddish, soft, brittle and weak, used in the dwellings of the poor.—BALFOUR, *page* 164.

Japhlota or ratanjot (*Jatropha curcas*).—Wood useless. The seed is a strong purgative. The tree is not commonly cultivated, as cattle die from eating the fruit, known as jamálgota in Hindústán. However, the jamalgota usually sold is *Croton tiglium*, not this.—MR. BARNES' *Kangra Settlement Report, para.* 154.

Kainth (*Pyrus variolosa*).—A wild fruit tree, known as the wild medlar; wood hard, used for agricultural implements.—MR. BARNES' *Kangra Settlement Report, para.* 158.

Kaimal (*Rottlera tinctoria*).—A tree of moderate size. Length of the trunk to first branch 5 feet, and girth 1 foot; wood of an earthy color, and of inferior quality; used by zemindars. The flowers yield a powder of a dirty red color, which is used as a medicine, known as "kamela," for expelling worms. In Shakespear's Oordoo Dictionary, this is spelt kamúd, and is described as "the name of dyeing drug, being the dust from the outside of the capsules of the *Rottlera tinctoria:* said to be also a purgative medicine and aphrodisiac."

Kemal (*Odina wodier*).—Grows to the height of 15 feet and more, with a good girth; wood of old tree is red, the outer wood is alone subject to worms; used for door frames and putaos.

Keor (*Holarrhena antidysenterica*).—Mentioned by MR. BARNES in para. 154 of his *Kangra Settlement Report*, and at page 130 of BALFOUR. A shrub; wood white, light, unsound. Bears a white flower, the seeds of which, called "indarjau," are used medicinally.

Khajúr (*Phœnix sylvestris*).—Grows straight and very tall, length of trunk being 50 feet, and girth 2 feet; attains full size in 40 years. Its wood is used for water conduits, and by zemindars for temporary bridges; leaves extensively employed for matting for floors. Its fruit, the date, is in much esteem.—BALFOUR, *page* 187.

Káugú (*Flacourtia sapida*).—A soft wood tree, used for ploughs, and produces small timber for zemindars' houses. Native combs are also made from this wood.

Kúrmrú (*Albizzia odoratissima*).—Grows to about 20 feet, and of good girth. A fair timber tree; wood rather soft.

Oí or Wilayiti sirris (*Acacia stipulata, A. Kangraensis of* JAMESON).—Grows to the height of about 25 feet. Wood of the old tree brownish, soft, brittle, light. Not ordinarily used as a timber for large buildings, but employed by zemindars in their buildings.

Paláh, or palás or dhák (*Butea frondosa*).—Grows large but generally gnarled; length of trunk to first branch 10 or 12 feet, and girth 4 feet. Attains full size in 40 years. Its wood is white, very fibrous, strong and durable; used chiefly as fuel, for which it is eminently adapted, and owing to its power of resisting the action of water, it is used as "nímchaks" or curbs which support the masonry of wells. The red gum which exudes from the bark, and called "kamar kas," is an article of commerce, being valuable as a native medicine. The flowers, called "kesú," give a yellow dye, known as "basantí." The leaves are used as trenchers. BALFOUR, *page* 61; *and Roorkee Proceeding Papers on Gwalior Timber, page* 37.

Pípal (*Ficus religiosa*).—Attains a great size, length of trunk to the first branch being

10 feet, and circumference 10 feet. Its wood is red, readily attacked by white ants, and fit for nothing but fuel. The tree affords great shade, and is held in veneration by Hindús. —Mr. Barnes' *Kangra Settlement, para.* 157; *Roorkee Proceeding Papers on Gwalior Timber, page* 34.

Réh (*Abies smithiana*).—Grows like the "kelú," which it resembles in appearance, except that its leaves grow droopingly. Wood white, soft, light, unsound. Not valuable as building timber, but in Bungahal, the people use the wood as shingles to cover their houses.—Mr. Barnes' *Kangra Settlement Report, para.* 145; *and* Balfour, *page* 189.

Rauṅs (*Cotoneaster sp. var*).—A small tree; the wood used for walking sticks.

Sarú (sarv), (*Cupressus sempervirens*).—An ornamental tree in gardens.—Balfour *page* 92.

Sembal, cotton tree (*Bombax heptaphyllum*).—Grows very tall and straight. Length of trunk to first branch 80 feet, and girth 12 feet. Attains its full size in 60 years. Wood white, light, but not strong, and brittle, used for boxes and doors, and water conduits; white ants readily attack the wood. The cotton is used for stuffing pillows, but is in no request, and seldom gathered in these hills. Leaves used as fodder. The roots of young trees produce the "safed múslí," which is used to make a cooling beverage. Scabbards are made of this wood.—Balfour, *page* 53; Mr. Barnes' *Kangra Settlement Report, para.* 157; *Roorkee Proceeding Papers on Gwalior Timber, page* 35.

Tos (*Picea Webbiana*).—Grows like the "reh," and its uses are the same.—Balfour, *page* 189; Mr. Barnes' *Kangra Settlement Report, para.* 145.

Amáltás, or kanyár or kyár (*Cassia fistula*).—Wood useless. Bark used by tanners in dyeing leather. Fruit used medicinally.

Class C.

Aihlan or elan (*Andromeda ovalifolia*).—Useless except for firewood; goats and sheep die from eating its leaves.

Badarín? (*Ficus glomerata?* P.B.)—Bears a fruit which is brought to no use. The tree resembles the "pípal;" and its wood, which is soft, is not used for either agricultural or building purposes.

Beter, bethar or pethri (*Juniperus squamata, J. communis.*)—A fuel wood. Found at very high altitudes where forests disappear.

Dagúran?—A shrub. The wood is used as fuel, and the leaves are given to buffaloes as fodder.

Dháoṅ chota (*Grislea tomentosa*).—An underwood, which grows 4 or 5 feet high, used for fuel and by abkárs, or liquor distillers, for fermenting liquor.

Gándla (*Bergera Kœnigii*).—A shrub. Wood used as useful, and the leaves to foment bruises or hurts.

Garnah (*Carissa diffusa*).—A thorny shrub, bearing a small black edible fruit; native combs are made from the wood, which is also used in fences. The wood of a very old tree turns quite black, and acquires a strong fragrance, and is considered as a valuable medicine, and sold at a high price, under the name of "agar;" goats and sheep eat the leaves.

Hísú, girua or híru (*Capparis sp*———).—A shrub, with thorns in the shape of fish hooks; and smaller and fewer than those in "garna," which it much resembles. Roots used for sores; goats and sheep eat the leaves.

Jarerí (*Zizyphus nummularia?*)—A throny shrub, used for fences.

Kasmal (*Berberis sp. var*).—The barberry tree. Wood yellow and useless except for fences. "Rasaut," which is used among natives for sore-eyes, is extracted from the roots. —BARNES' *Kangra Settlement Report, para.* 158.

Kainthí (*Indigofera arborea, &c.*).—A shrub, with useless wood fit only for fuel. The blossoms are used in food by the natives.

Umbára (*Spondias mangifera*).—Grows to the height of 10 or 15 feet, of pretty good girth. Wood very soft and brittle; not used as timber; produces sour fruit used in pickles; leaves sour, used as "chutnee" or acid sauce.

Pansra (*Colebrokia oppositifolia*).—A shrub; wood used as fuel, and the leaves as fodder for cattle.

Paliyára (*Erythrina stricta*).—Wood used for fuel and for scabbards of weapons. Bears a bright red flower.

Phagúra (*Ficus caricoides*).—Produces a kind of edible fig. Wood used for fuel and agricultural purposes.

Rúmbal, gúlar (*Ficus glomerata*).—Grows as high as, and resembles, the "peepul;" wood useless except for fuel. Bears a large but useless insipid fruit.

Angúr, or wild grape, called maljar (*Vitis racemosa*).—Used by zemindars as "bunds" or ties for their fences.

Besides these, in an earlier list in the Financial Commissioner's Office, are given

Daheo (*Artocarpus integrifolia*).
Vúná (*Viburnum fœtens*).
Batkar (*Celtis caucasica*).
Barna (*Cratæra religiosa*).
Kumbí (*Careya arborea*).
Rárá (*Randia dumetorum*).
Karak (*Celtis tetrandra*).
Girthan (*Fluggea leucopyrus*).

The Hushyarpúr forests are still utilized; also the Mahan and Santha forests of Kangra. In Hushyarpúr the principal tracts are the Lohára and Panjál: the trees are principally cut for "balis" (bullies or poles) which are sold at 2 to 3 Rs. per hundred, according to the thickness of the wood, which varies from 6 to 10 inches, and the length varies from 10 to 18 feet. A great number are taken down to the plains to Amritsar: they cost after paying all expenses, about Rs. 40 per hundred. The best months for cutting are September to January: if cut between February and August decay is rapid.

Larger trees are paid for at Rs. 5 per tree, and floated down the Beás from Dehra. The Hushyarpúr revenue (gross) in 1862-63 amounted to Rs. 8,452-2-6, Rs. 2,242-7-4 being derived from "chil," and 6,209-11-2 from bamboo.

In the Siwálik ranges of the Hushyarpúr distrct, there are, in Punjab territory, two bamboo jungles, at Bindraban and Karampúr. These are preserved, and are only allowed to be cut by traders furnished with regular passes, to be obtained at the tahsil. The price of the best bamboos is 3 Rs. per hundred, and the charge for cutting 8 annas.*

The only other district which I can here mention having a submontane growth of woods, in which forest operations and conservancy are carried on, is Rawalpindi.

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* DR. CLEGHORN'S Report. p. 77. A number of the best forests in Hushyarpúr and Kangra, are now in charge of the F. D.

"There are considerable tracts of waste," says Dr. Cleghorn, "land partly hill and partly ravine, not producing lofty trees, but yielding a large amount of fuel, on which sissoo might be raised, and existing species be reproduced." The principal trees are "chír" (*P. longifolia*), *Quercus incana*, mulberry, tún, and its congener "drawa" (*Cedrela serrata*), sissoo, olive, phuláhi (*Acacia modesta* and *Vitex*).

No one is allowed to cut but by express permission, an official being sent with the applicant to mark the very trees required. Fir trees are charged at Rs. 3 and 4. Valuable wood, as "kangar" (*Pistacia interigerrima*) and "tún," at Rs. 5 to 10 even. The principal of the forest tracts are on low hilly ranges, such as that running from Shaldetta to the Jhilam river, Kharí Múrth mountain, and the range beyond Fatih Jang and Malikpúr, &c. The total area of the lands is given at 71,009 acres. In the Rakh Topi, which is close to Rawalpindi, much has been done by opening up pathways, sowing seed broadcast, &c., to improve and conserve the forest. A list of the rates of seignorage is given at p. 205 of Dr. Cleghorn's Report.

I now come to the last of our divisions, viz., the forests actually in the plains, and the attempts that has been from time to time made at Arboriculture generally.

There is scarcely a tract of country which deserves the name of a forest, but extensive waste land or "rakhs" often contain stunted growths of various kinds of trees, valuable as fuel; in others stumps and roots of the "jhand" (*P. spicigera*), and other shrubs are dug out in immense quantities, and serve for railway fuel.

One tract, however, which may be called a forest, deserves mention separately, and that is the Kachhi tract, on the banks of the Indus, in the Leia perganah. This tract has been described by Mr. Cowan, being subsequently visited by Dr. Cleghorn, and has been fully reported by Dr. J. L. Stewart.

"The Kachhi is the low land on the left bank of the Indus, commencing at Marí, opposite to Káiábágh, and extending in one form or other, I apprehend, to the sea. In the lower portions, as you are doubtless aware, bábúl, in some parts predominates. Tamarisk more or less exists everywhere; and jhand, karíl, with other shrubs or trees adapted for fire-wood, are largely scattered over the entire area of most portions, in greater or less density. In the upper portion, however, appertaining to the Míyáñwallí tahsil, the shísham (*Dalbergia sissoo*) greatly predominates, and appears to spring up spontaneously wherever the soil deposited by the river is left undisturbed, for a distance of at least 30 to 40 miles below Kálábágh.

"I cannot explain, with any confidence the reasons of this difference, but presume that it is owing, partly to the deposit of the river at that part immediately on its immerging from the hills being more richly charged with a tenacious soil suitable for the growth of sissoo, than in the lower portions of its course, and partly to its meeting in the hills with sissoo forests, from whence it brings down the seeds, depositing them as soon as it enters the plains.

"I have recently myself traversed a portion of this Kachhi. I was not able to visit the forest properly so called, but I met with numerous self-sown sissoo trees in the area of almost every village.

"They are for the most part scattered about as single trees, or in groups of two or three amongst the fields, or rather between them—the people are not allowed to cut them without special permission, and some of them are very fine growth and considerable girth.

"The forest which commences south at the village of Bakkra, and extends along the low alluvial land to a distance of 14 or 15 miles (its extreme northern limit being the village

of Fatihkhánwala) seems to have been of spontaneous growth. During the Sikh rule few people inhabited that part of the country, and those few were not possessed of large herds of cattle; consequently, as the Kachhi land became more thickly populated, flocks and herds increased to the detriment of the young trees, while the old trees were annually destroyed by the inundations, which for the last five years have been so excessive that numbers of trees are torn up by the roots, some of them being swept away with the current, and the rest are collected in the succeeding cold season and sold by auction.

"Some of the finest trees in the forest were felled when the Leia station was built, and a quantity of timber from the Kachhi forest was sent for the construction of the Attock bridge-of-boats; moreover, at one time the Leia authorities fixed the price of a shísham tree at 5 Rs. without restriction, and as may be imagined, the forest was considerably thinned thereby."

Dr. Stewart remarks* that there is no tradition on the spot and no reason to believe that the Leia forest (here always called Tálí) ever covered a larger space than it does now; though, no doubt, it was more compact. The floods of 1856 did great damage, and the unvarying price of Rs. 5 per tree led to all the finest being picked out.

"Kachhi" is a generic term for wet, or low alluvial land and islands lying along the course of the Indus. "Almost the whole of the forest worthy of being taken into account is situated on part of the series of low islands, among which meander the numerous and variable channels into which the Indus is divided for many miles below Márí and Kálábágh." At a mile and a half from Kálábágh there is on an island a considerable forest of young trees, which will become valuable. Patches of single trees of sissoo are seen all along. The true forest begins at Madatkhánwalla, it then extends with more or less compactness to Bakkra, 20 miles below. Míyáñwallí is nearly opposite the centre of the forest. The breadth over which the trees extends is seldom over 4 miles, and is frequently less; indeed, in many places, either there never was any forest, or it has been entirely cleared away.

Besides, over this tract of 80 square miles, there are a considerable number of trees on the main land at Rokia, 7 miles above Míyáñwallí. In 1865 a return of trees gave 32,895 full grown, and 4,551 smaller ones.

In the plains the "rakhs" next deserve attention. In some parts of Thanesar and adjacent districts, there are jungles, consisting principally of "dhak" (*Butea frondosa*); the trees are not good, but scraggy and stunted: the leaves are used by native shop-keepers and grocers to wrap up things in, and maunds of the leaves are brought in from the jungles for this purpose; a revenue is also derived from the flowers, which are gathered under the name of *gulkesú*, and form an orange dye: the sight of one of these jungles in April, all covered with these flame-colored blossoms is very imposing. The "dhak" yields a gum of great astringency, called "kamarkas."

In the first Report of the Punjab Administration, there is a description of "rakhs," which is so graphic, that I shall need no apology for extracting it in this place.

After describing the fertile soil and rich cultivation that marks the course of the Punjab rivers, and extends inwards towards the centre of each Doab, the writer goes on to say—

"Far different is the sad and strange scene which meets the eye in the centre of all the doabs.

* Report on the Kachhi Forest, page 2, sec. 6.

"There are interminable waste overgrown with grass and bushes, scantily threaded by sheep walks and footprints of cattle. The chief tenants of these parts are nomad pastoral tribes, who, knowing neither law nor property, collect herds of cattle, stolen from the agricultural districts. Here and there a hamlet stands alone in the wilderness, tenanted by a semi-barbarous population, the very aborigines of the land: around the homesteads there will be patches of good cultivation, and the soil is rich and repays irrigation, although the water be deep below the surface. But there are constantly recurring tokens to show that once this region was not inferior to the most favorable districts. Everywhere are seen ruined cities, villages, temples, tanks, wells and water-courses. Such are the changes which have passed over this country! But it would be an error to suppose that this region is merely an object of scientific or historical interest: it possesses a practical and appreciable importance. It is the only source from which the capital, the chief towns and cities, the great British cantonments, can be supplied with fire-wood. It yields an abundant supply of grass for all equestrian establishments. It sustains, with its inexhaustible pasturage, a noble breed* of cattle, buffaloes, sheep and goats. Its boundless grazing grounds supports the race of camels that mainly carry on the Kábul traffic. Portions of it will become the scene of gigantic undertakings, which will tax the skill and resources of the State; but which will ultimately yield an ample return for the outlay of the capital. Indeed, the Punjab could ill spare its wastes, they are almost as important as the cultivated tracts."

Tracts of "rakh," or waste land, are to be met with, in portions of many districts, I have no return at hand of the "rakhs" of the whole province, but in the Lahore district there are no less than 86 such tracts, consisting of plots of uncultivated ground; the total area is 2,50,000 acres, but not all of this yields wood—a great deal is grazing ground, much of which is quite capable of being brought under cultivation. In Gujranwalla there are 62 rakhs, while in other districts there are none.† The income of "rakhs" for Lahore in 1860 was Rs. 30,058-1-5, and that of Gujranwalla Rs. 6,449-9-4, making a total of Rs. 36,507-10-9 for the Lahore division, after deducting expenses of establishment, &c., &c.; the net profit was Rs. 31,472-2-8. This will serve as a specimen for several divisions similarly situated, but the Gugaira and Jhung districts, bring in much larger incomes. In the Múltán division, but *excluding* the Jhung district, the total area of waste land amounts to 41,71,832 acres, of which the reserved tracts amount to 1,95,000 acres. These, however, are principally valuable as grazing grounds, and bring in a return as "tirni," grazing tax—these are foreign to our subject.

The great value of the wood-bearing rakhs consists in their being the source from which all the fuel for Railway consumption is to be taken. Not only is the upper growth of wood valuable in this way, but the roots that remain in the soil after the stunted growth has disappeared from the surface are equally capable of being utilized. Grubbing up the roots is however usually prohibited, as a fresh growth may be afterwards produced: it is only in clearly tracts for cultivation that the root stocks are removed. The best of these rakhs are now being reserved and demarcated for Government, and placed under the charge of proper officials. In some places plantations of kikar, shísham, &c., have been started, and a large proportion of them are now doing well. "If," writes Dr. Cleghorn, "the 'rakhs' in the Lahore, Amritsar, and other districts, be capable of irrigation, they should not in

* The bovine cattle form an exception. Though superior to the ordinary cattle of the Punjab, they are quite inferior to the Hindústáni breed of Hansi and Hissar.

† Such as Sealkot and Gurdaspúr.

on this account be given up to cultivation, but suitable area of compact shape, and having (if possible) good soil, should be appropriated for the growth of timber trees. Sissoo, babul, seriss and jhand, grow well in the Punjab on lands liable to be submerged, or with a little irrigation, and other useful woods will doubtless be found to succeed.*

The Gugaira district contains more than 1,80,000 acres of jungle: Dr. Stewart† thinks this under estimated.

The Gugaira district is nearly all of "bár" land, and is separated into various tracts having distinctive names; the central and highly elevated part is called "ganji bár" (lit. "bald"); it produces saline plants, which pasture camels, and some *Salvadora*: the strips lying on either side of the "bár" constitute the fuel-producing portion, the area of these extends to 250,000 acres, and is often covered with tamarisk, yielding 100 to 150 maunds of wood per acre; the reserved tracts amount to 30,000 acres, they contain the best *jhand* tracts.

The trees most commonly met with in "rakhs" are as follows:—

Jhand (kundi in Sindh), *Prosopis spicigera.* This is the best fuel wood, being heavy and compact, and burns slowly: when stacked it is liable to be attacked by white ants.

Phuláhí (*Acacia modesta*). Not found in the southern district.

Palás or dhák (*Butea frondosa*). In Amritsar, and also east, but not in the south.

Karíl (*Capparis aphylla.*) The leafless caper, it will burn while green and gives out great heat; but otherwise is not esteemed as a fuel plant.

Jál or váñr—(*Salvadora oleoides*). It is a bad fuel, quite useless for locomotives, but can be used for steamers. *Salvadora indica* also occurs in the south, it is called "kaura vári."

Tamarisk. Three species occur—farwá, farás, or ukhán. *Tamarix orientalis* grows easily and rapidly to a large tree, and is resinous and a good fuel, but emits a bad smell in burning.

The next species is the lai (*Tamarix indica*), a large shrub; and the next, chilchí (*T. dioica*), is a small shrub wood, for basket work, &c. It grows by the sides of rivers, &c.

Bhán (*Populus euphratica*). Abundant in the south. The wood is light, and while burning throws out sparks or burning flakes which endanger the steam-boats.

Malláñ (*Zizyphus nummularia*). Is very common, but only used for fodder; it has no wood to speak of.

Dr. Stewart gives in his list some other woods as rarer in "rakhs"—such as *Acacia arabica, A. Jacquemontii, A. eburnea* (babur), *D. sissoo, Z. jujuba,* and kangú (*Lycium Europeum*).

In conclusion, it remains to notice the trees that grow about the fields and villages, and the progress of Arboriculture.

The trees commonly seen, are the kíkar (*A. arabica*), the beri (*Z. jujuba*), the siras (*A. serissa*), the shísham (*D. sissoo*), the mulberry (*Morus indica, &c.*), and near wells the sohájna (*Hyperanthera moringa*). Trees are generally planted round the wells, and also on the borders of fields; round the villages, trees of these kinds are met with, as well as often large fig trees, banyan and pepul, under the shade of which the villagers gather to rest from their labors.

In Lahore, and in the Southern districts, clumps of *Elate sylvestris*, the wild palm, are met with, and produce a pleasing effect. Groves and topes of mangoe trees and jámun (*Sizygium*

* Memo. on "Rukhs" (1863), in Financial Commissioner's Office.

† In his Fuel Report, in letter No. 121, from Dr. Cleghorn to the Financial Commissioner, 17th Sept., 1864.

jambolanum) are not uncommon; in gardens, the willow (bedmushk) is grown for its flowers, from which willow flower water is made, and is highly esteemed by natives as a refrigerent; also orange and lemon and lime trees, pomegranate, peaches and fálsa (*Grewia asiatica*), and occasionally apples and pears, and plums. The large public gardens are principally filled with mangoe treos: the idea of a "garden" is almost synonymous with our idea of an "orchard."

To detail the various attempts that have been made to introduce foreign trees is not within the scope of this sketch, but a few that are more common may be noticed.

At Madhopúr, the *Casuarina* and the *Eucalyptus* have flourished wonderfully; the tún (*Cedrela toona*), a valuable tree, grows along the canals, and ought to be very largely cultivated. The *Eucalyptus* thrives well everywhere almost, but it frequently dies when young if it gets too much water during the rains; combined heat and great moisture it cannot stand. *Ailanthes excelsa*, that magnificent tree, bids fair to be introduced; as well as the carob bean (*Ceratonia siliqua*), and some of the Salt Range trees—*tecoma*, box, olive, &c., are being tried.

The principal places where tree planting can be carried on is along the canals, and along railroads, and ordinary high roads: this has been done extensively in the Punjab, and with the best results. It is quite the exception now to travel on a road (anywhere near the Grand Trunk, and in the well-watered districts) which is not lined with trees; a great part of the Bari Doab Canal is lined with trees.

Of course the districts vary much, according to their situation and climate. In the dry regions of the south, the desert is redeemed by the palm tree, the jál, the jhand and the tamarisk, which grow to a fine size in Muzaffargarh and other districts. In Jálandhar and other districts the scene is very different, there verdure is everywhere at hand: and in tracts like Bajwát in Sealkot, the country is almost a perpetual groove.

In concluding this sketch, I would warn the reader, that its object is only to describe in a very general manner the forests tracts of the Punjab, so as to show what is going on, and what are the characteristics of the province in this respect: any one who wishes to study the subject in detail, I would refer him to the original reports of Drs. Brandis, Cleghorn and Stewart, and the various papers in the Agri-Horticultural Society's Journal, from which I have collected the materials for this notice.

To an introductory sketch like the present, it belongs only briefly to notice the successive zones of vegetable production, which furnish the samples in the collection, and to account for that wide scope, which includes in one collection, the products of all regions, from the inmost fastnesses of the Himálaya, along the banks of mountain streams, where the deodar and the giant pines flourish, and thence descending to the submontane tracts of varied foliage, until we reach the plains, and find ourselves on the arid deserts of the south, where nothing save the wild palm, or the stunted caper, waves over the burning expanse of sand.

Every one of these varied regions is represented in the following list, and the vegetable forms that meet us in successive zones, seem as signs that point to localities, the possible homes of the products of other lands to be introduced, only asking for capital, for enterprise, and for resolution, to render back ten-fold the outlay first devoted to them.

In enumerating the woods of the Punjab, I have adopted a slightly different method for the sake of presenting the botanical products of this class at one glance, without breaking up the unity of the list by a reference to locality or territorial divisions; but in order that the

reader may not be at a loss to know to which district he may refer a given tree, a list is first given of the specimens contributed by various districts, and then follows a glossary describing the principal woods of the Punjab. The foundation of this is an excellent list, kindly furnished by Dr. Cleghorn, and containing some 137 species. This list I have amplified by adding many more species, *including any tree or shrub which was large enough to have any wood and to be useful for fuel or charcoal:* smaller plants than this have not been included. For the variety of native names and synonyms, I have greatly to thank Dr. Stewart, who communicated a number; of the others, several I have collected myself on various tours, others have been derived from books and papers—Jameson's list, Cleghorn's Report, Brandis' Basáhir Reports, Aitchinson's Jhelum, Stewart's Wazíristán; also his reports on the forests of the Chenáb, Ravi, and other rivers; from Royle, Hooker, Thomson, and many others.

Delhi.

Name of tree.	Locality.	Remarks.
Sál (*Shorea robusta*). Sissú, white, } (*Dalbergia sisso*). Ditto, black, } Kíkar (*Acacia arabica*). Mulberry (*Morus alba*). Háldi, or zard chob (*Nauclea*). Mango (*Mangifera indica*). Wild fig (*Ficus caricoides*). Tún, hill, } (*Cedrela toona*). Ditto, canal, } Guava (*Psidium pyriferum*). Cotton tree (*Bombax heptaphyllum*). Tamarind (*Tamarindus indica*).	Delhi.	Sent by C. E. Campbell, Esq.

Rohtak.

Name of tree.	Locality.	Remarks.
Kíkar (*Acacia arabica*). Ním-bhur or nim ber (*Zizyphus*). Bukhain (*Melia simpervirens*). Jhand (*Prosopis spicigera*). Jál (*Salvadora oleoides*). Khair (*Acacia catechu*). Beri (*Zizyphus jujuba*). Barnah (*Cretæva religiosa*). Tamarind (*Tamarindus indica*). Rahíra (*Tecoma undulata*). Hinggo (*Balanitis Ægyptiaca*). Sissú (*Dalbergia sisso*). Ním (*Melia azadirachta*). Farásh (*Tamarix orientalis*). Pípal (*Ficus religiosa*). Kaim (*Nauclea parviflora*). Mango (*Mangifera indica*).	Rohtak.	Sent by Liut.-Col. Voyle.

Name of tree.	Locality.	Remarks.
	ROHTAK—*(Continued)*.	
Jáman (*Sizygium jambolanum*).		Canal villages.
Mulberry, tút (*Morus*).		Canal villages.
Dhák (*Butea frondosa*).		Canal villages.
	SIRSAH.	
Sponge wood, "shola" (*Æschynomene paludosa*).		Sent by P. A. MINAS, ESQ.
	SIMLA.	
3 bamboo sticks.	Mahlog.	
Hill bamboo, nirgalli (*Arundinaria utilis*).	Kunyar.	
Box of 36 hill woods, viz. :—	Kotgarh.	MR. S. BERKELEY.
Kail (*Pinus excelsa*).	Kotgarh.	MR. S. BERKELEY.
Rái (*A. smithiana*).	Kotgarh.	MR. S. BERKELEY.
Spruce fir, pándrai (*Picea Webbiana*).	Kotgarh.	MR. S. BERKELEY.
Jamnú (*Prunus padus*).	Kotgarh.	MR. S. BERKELEY.
Brás (*Rhododendron arboreum*).	Kotgarh.	MR. S. BERKELEY.
Tung (*Rhus parviflora*).	Kotgarh.	MR. S. BERKELEY.
Titarí (*Rhus semialata*).	Kotgarh.	MR. S. BERKELEY.
Kakar (*Pistacia interigerrima*).	Kotgarh.	MR. S. BERKELEY.
Common oak, báu (*Quercus incana*).	Kotgarh.	MR. S. BERKELEY.
Báni (*Quercus annulata*).	Kotgarh.	MR. S. BERKELEY.
Mohru (*Quercus dilatata*).	Kotgarh.	MR. S. BERKELEY.
Alpine oak, kharsú (*Q. semicarpifolia*).	Kotgarh.	MR. S. BERKELEY.
Himalayan box, shamshád (*Buxus sempervirens*).	Kotgarh.	MR. S. BERKELEY.
Dogwood, kágshi (*Cornus macrophylla*).	Kotgarh.	MR. S. BERKELEY.
Hill mulberry, kímú (*Morus serrata*).	Kotgarh.	MR. S. BERKELEY.
Walnut (*Juglans regia*).	Kotgarh.	MR. S. BERKELEY.
Hill toon, dark (*Cedrela toona* var *serrata*).	Kotgarh.	MR. S. BERKELEY.
Sissú (*Dalbergia sissoo*).	Kotgarh.	MR. S. BERKELEY.
Yew, tuna (*Taxus baccata*).	Kotgarh.	MR. S. BERKELEY.
Himalayan chesnut, bankhor (*Pavia indica*).	Kotgarh.	MR. S. BERKELEY.
Bekul (*Prinsepia utilis*).	Kotgarh.	MR. S. BERKELEY.
Olive, zaitún (*Ocea Europæa*)	Kotgarh.	MR. S. BERKELEY.
Rawásh or rauns (*Cotoneaster obtusifolia*).	Kotgarh.	MR. S. BERKELEY.
Bird cherry, pacha or pája (*Prunus puddum*).	Kotgarh.	MR. S. BERKELEY.
Apricot, zard áru (*Prunus armeniaca*).	Kotgarh.	MR. S. BERKELEY.
Basúr.	Kotgarh.	MR. S. BERKELEY.
Wera.	Kotgarh.	MR. S. BERKELEY.
Nawir or Neúr, lewar (*Cupressus torulosa*).	Kotgarh.	MR. S. BERKELEY.
Bajwul.	Kotgarh.	MR. S. BERKELEY.
Pedu.	Kotgarh.	MR. S. BERKELEY.
Karandlú (*Acer lævigatum*).	Kotgarh.	MR. S. BERKELEY.
Katálat.	Kotgarh.	MR. S. BERKELEY.

Name of tree.	Locality.	Remarks.
Simla—(*Continued*).		
Shágul.	Kotgarh.	Mr. S. Berkeley.
Tálma or thalín (*Viburnum fœtens*).		
Kamúshal.		
Deodar, kelu (*Cedrus deodara*).	Simla district (24 woods used by the carpenters at Simla.)	Sent by Dr. Cleghorn
Lofty pine, kail (*P. excelsa*).		
Common oak, bán (*Quercus semicarpifolia*).		
Deru or mohru (*Q. incana*).		
Toon tree (*Cedrela toona*).		
Box (*Buxus sempervirens*).		
Mulberry, kímú (*Morus serrata*).		
Kakar (*Pistacia integerrima*).		
Tung (*Rhus cotinus* or *parviflora*).		
Walnut (*Juglans regia*).		
Wild pear (*Pyrus variolosa*).		
Cherry (*Padam*).		
Apricot (*Prunus armenica*).		
Maple (*Acer cultratum*).		
Ayár (*Andromeda ovalifolia*).		
Bráh (*Rhododendron arboreum*).		
Kaiphal (*Myrica sapida*).		
Kachnár (*Bauhinia*).		
Nettle tree, karak, bichwá (*Celtis Caucasica*).		
Tezbal (*Xanthoxylon hostile*).		
Berberry (*Lycium berberis*).		
Chuhi, *Acacia speciosa* (looks like *Boswellia*).		
Soapnut (*Sapindus acuminatus*).		
Hill bamboo (*Arundinaria utilis*).		
Rauns (*Cotoneaster obtusifolia*).		Used for making walking sticks in the Hills.
White thorn, gengáru (*Cratæva crenulata* or *C. oxycantha*).		
Kangra.*		
Pencil cedar, "pratakpá" or "yuckpa" (Thibetan), (*Juniperus excelsa*).	Spiti.	
Amritsar.		
Báns (*Bambusa stricta*).	Wood obtained in the bazar, and in the district of Amritsar.	
Farwá (*Tamarix orientalis*).		
Ber (*Zizyphus*).		
Sembal (*Bombax heptaphyllum*).		
Rerú (*Acacia Jacquemontii*).		
Andal, pine ?		
Zheel.		

* The other woods of Kangra and Jálandhar have already been given at page 538, *et seq.*

Name of tree.	Locality.	Remarks.
Amritsar.		
Deodar.	Woods obtained in the bazar, and in the district of Amritsar.	
Tháli (*Dalbergia sissoo*).		
Toon.		
Ambárá (*Spondias mangifera*).		
Safeda (*Populus*).		
Kíkar, paharí (*Acacia*).		
Arú (*Amygdalus*).		
Sembhálú (*Vitex*).		
Maidá (*Tetranthera*)		
Kamb, kadamb ? (*Nauclea*).		
Khatta (*Citrus medica*).		
Anár, pomegranate.		
Lobán.		
Khair (*Acacia catechu*).		
Kadamb (*Nauclea*).		
Khajúr (*Phœnix sylvestris*).		
Khiláwa or khilárá (*Wrightea mollissima*).		
Chikrí (*Buxus sempervirens*).		
Rárá (*Randia*).		
Kíkur (adantí), (*Parkinsonia*).		
Dákh (*Butea frondosa*).		
Almond tree, badám (*Amygdalus communis*).		
Walnut (*Juglans regia*).		
Kíkar (*A. arabica*).		
Karír (*Capparis aphylla*).		
Phulláh (*Acacia modesta*).		
Jand (*Prosopis spicigera*).		
Lahore.		
Nepál box (*Buxus nepalensis*).	Nepál and Kúlú.	The specimen was accompanied by a section smoothed for the engraver.
Lemon wood (*Citrus medica*).		Grown in the Bádámí Bágh, Lahore.
Orange wood (*C. aurantium*).		
Rawalpindi.		
Minassi.	Murree Hills.	
Kakar (*Pistacia intigerrima*).		
Kummuldai.		
Urvál, ardwal (*Rh. arboreum*).		
Sírí.		
Pear, "nakh."		
Tassí (*Bauhinia*).		
Laknáb.		
Bhehkar (*Prinsepia utilis*).		

RAWALPINDI—(*Continued*).

Name of tree.	Locality.	Remarks.
Akta (*Rubus* ?)		
Kamela (*Rottlera*).		
Kakkar (*Pistacia* ?)		
Sanatta (*Dodonæa*).		
Timbar (*Xanthoxylon hostile*).		
Medasak (*Tetranthera*).		
Pípal.		
Amlaha (*Emblica officinalis*).		
Garunda (*Carissa diffusa* ?)		
Bankau (also written in original list, ban kahoo), (*Quercus annulata* ?)*		
Kakohí (*Acacia Jacquemontii*), or for kákshi (*Cornus macrophylla*) ?		
Khúkal.		
Phúlah (*Acacia modesta*).		
Rukan or ruknu (*Sizygium*).		
Kahí (*Ulmus*).		
Pussun.		
Príta.		
Kúlairí, kalíar, or kalírí (*Bauhinia racemosa.*)		
Yew, barmí (*Taxus baccata*).		
Kúnth.	Murree Hills.	
Báti.		
Títar (*Rhus semialata* ?)		
Guláb janglí (*Rosa Burmanniana*).		
Dhaik (*sic*), perhaps dhák (*Butea frondosa*).		
Apricot, hári.		
Wild plum, kálakát (*Prunus padus*).		
Horse chesnut, ban akhrot (*Pavia indica*).		
Barwallí.		
Bais (*Salix*).		
Pasarí, paser (*Parrotia Jacquemontiana*).		
Mulberry.		
Paon, pháun.		
Punra (*Ehretia serrata*).		
Sakí (*Cotoneaster*).		
Darúní (*Punica granata*).		
Chumáriya.		
Gwál bodála.		
Tangí (*Pyrus sp*—— ?)		
Shísham.		
Chír (*P. longifolia*).		
Barbery, samálú (*B. lycium*).		
Táví (*Grislea tomentosa*).		
Amánoí.		

* The Local list gives (*Vitex negundo*).

Name of tree.	Locality.	Remarks.
Rawalpindi—(*Continued*).		
Jammú (*Sizygium jambolanum*).	Local Exhibition Committee.	Murree Hills.
Cháhan.		
Tanda, dhatanda.		
Changhát, chamkát (*Desmodium tiliæfolium*).		
Chitra (*Staphylia emodi*).		
Walnut.		
Niberva.		
Peach, arú.		
Amlok (*Diospyros lotus*).		
Kutti (*Daphne oleoides*).		
Barungi, "ilex" (*Quercus dilatata*).		
Tánee, thalí (*Dalbergia*).		
Satarí (*Nussiessya ?*)		
Taikun.		
Bakarwand.		
Tríkadna (*Acer cultratum*).		
Butairí, or tílrí (*Rhus semialata*).		
Kandar (*Cornus macrophylla*).		
Drava (*Cedrela sp——?*)		
Iríñ, ríñ (*Quercus incana*).		
Sáfedah, poplar (*Populus alba*).		
Palúndar (*Picea Webbiana*).		
Batkar (*Celtis nepalensis ?*)		
Batánk, wild pear (*Pyrus variolosa*).		
Chát (*Æschynomene Ægyptiaca*).		
Bahaira (*sic*), specimen is bíar (*Pinus excelsa*).		
Phagwárí (*Ficus caricoides*).		
Palách, faláh (*Populus ciliata*).		
Shamshád, country box-wood (*Buxus sempervirens*).		
Gujrat.		
Sisú.		
Kíkar.		
Siriss.		
Phullahi.		
Ber.		
Búkhain.		
Tút, mulberry.		
Lasora (*Cordia myxa*).		
Jáman (*Sizygium jambolanum*).		
Barna (*Cratæva religiosa*).		
Dhák.		
Pípal.		
Sohájna, horse radish tree (*Hyperanthera moringa*).		

Name of tree.	Locality.	Remarks.
	GUJRAT.—*(Continued)*.	
Bed, willow (*Salix Babylonica*).		
Bor or bargat (*Ficus indica*).		
Khair (*A. catechu*).		
Pharwán (*Tamarix indica*).		
Sukchaina (*Pongamia glabra*).		
{ Rúmal,* rúbal (*Erythrina ?*)		
{ Khirni.		
Amla (*Emblica officinalis*).		
Cotton tree (*Bombax*).		
Kachnár (*Bauhinia variegata*).		
Jhand (*Prosopis spicigera*).		
Karír (*Capparis*).		
Wannah (*Salvadora oleoides*).		
Ajaurukh (*Acacia Jacquemontii*).		
	JHILAM.	
Sísú.	Jhilam.	
Siriss.		
Bukain.		
Banyan, bargad (*Ficus Indica*).		
Kamla (*Odina wodier*).	Tilla Mountain (Salt Range).	There is a specimen of the gum of the kamla of an amber brown color.
Kíkar.	Jhilam.	
Kakkar (*Rhus acuminata*).	Tilla Mountain.	
Wild olive, kau (*Olea europæa*).		Walking sticks are made of this wood.
Ber.	Jhilam.	
Phúlah (*Acacia modesta*).	Tilla Mountain.	
Sohájna.	Jhilam.	
Dháman (*Grewia elastica*).	Tilla Mountain.	Wood used for buggy shafts (Local List). Wood esteemed useless as a timber (Local List).
Kíkar Wilayití (*Parkinsonia*).	Jhilam.	
Mulberry, tût.		
Kachnár.		
Lasúra.		
Dhák (*Butea frondosa*).		
Olive, kao (*Olea ferruginea*).	Salt Range.	
Phuláhí (*Acacia modesta*).		
Lahúra (*Tecoma undulata*).		
Jalidhar (*Gymnosporia spinosa*).		
Larga (*Rhus cotinus*).		
Sagghar (*Ehretia aspera*).		
Dhaman (*Grewia elastica*).		Bows and shafts are made of it (Local List).

* The specimens bracketed are both *the same*, though different names are assigned.

Name of tree.	Locality.	Remarks.
SHAHPUR.		
Wathaman (*Celtis caucasica*).	Salt Range.	
Gargusa (*Acacia Jacquemontii*).	Salt Range.	
Chikrí, box.	Salt Range.	Used for agricultural implements.
Dhílá.	Salt Range.	Wood looks like that of a *Ficus*.
Kahimal.	Salt Range.	
Kangar (*Pistacia integerrima*).	Salt Range.	
Phooloha (*sic*), (*Pongamia*).	Salt Range.	
GUGAIRA.		
Tamarisk, farás.		
Mulberry, tût.		
Siriss.		
Kíkar (*Vachellia farnesiana*), Wilayiti kíkar (*A. arabica* var. *Cupressiformis*).		
Bukain (*Melia sempervirens*).		
Sissú (*Dalbergia sissoo*).		
Babul (*Acacia Arabica*)—pahárí kikar *Parkinsonia*).		
Dák (*Butea frondosa*).		
Lasúra (*Cordia myxa*).		
Jhand (*Prosopis spicigera*).		
Pípal (*F. religiosa*).		
Bor (*Ficus indica*).		
Ber (*Zizyphus*).		
Wild caper, karíl.		
Pílú (*Salvadora oleoides*).		
Cotton tree, sembal.		
Horse radish tree, sohajná.		
DERA ISMAIL KHAN.		
Kíkar.		
Mulberry, tût.		
Babul.		
Phuláhí.		
Sírín.		
Sissú.		
Ber.		
Mango, ám.		
Bukhain.		
Pine, chíl.		
Deodar.		
Bhán (*Populus Euphratica*)		
Olive.		
Lime, khatta (*Citrus*).		
Ditto, mitha (*Citrus*).		

Name of tree.	Locality.	Remarks.
DERA ISMAIL KHAN.—(*Continued*).		
Jál (*Salvadora oleoides*).		
Madár (*Calotropis Hamiltonii*).		
Horse radish (*Hyperanthera pterygosperma*).		
Pomegranate, anár.		
Kagal ? (*Tamarix orientale*).		
Lasúra (*Cordia myxa*).		
Kurinja (*Pongamia glabra*).		
Bainth, bed (*Salix Babylonica*).		
Súmala, sembal (*Bombax heptaphyllum*).		
Jaith (*Sesbania Ægyptiaca*).		
Gondí (*Cordia Rothii*).		
Chitarí (*Quercus ilex*).		
Gurgura (*Reptonia?*)		
Pullow (*sic*), (*Salvadora ?*)		
Grape, angúr (*Vitis*).		
Kangur (*Sageretia ?*)		
Alúcha (*Prunus domestica*).		
Gúrgará (*Reptonia buxifolia*).		
Karíl (*Capparis*).		
Mamání (*Sagentia Brandrethiana*).		
Bághúna (*Rhus cotinus*).		
Sísam (*Dalbergia sissoo*).		
Poplar, sáfeda (*Populus alba*).		
Ber (*Zizyphus jujuba*).		
Pípal (*Ficus religiosa*).		
Mulberry, tút. (The specimen is a red wood, not tút.)		
Peach, arú (*Amygdalus Persica*).	Kuhát.	
Phúlláh (*Acacia modesta*).		
Kharweí, (*Cotoneaster*).		
Khubára (*Ehretia aspera*).		
Willow, bed majnún (*Salix*).		
Bar (*Ficus Indica*).		
Olive, kau (*Olea Europea*).		
Tághan (*Celtis Caucasica*).		
Jháú (*Tamarix dioica*).		
Jál (*Salvadora oleoides*).		
Charáí or jarí (*Quercus ilex*).		
Bukain or drek.		
Sharauní (*Flacourtia sepiaria ?*). (May be *Pistacia integerrima ?*)		
Wild olive, kau (*Olea Europea*).	Higher Hills.	
Mulberry, tút (*Morus lævigata and alba*).		
Sirín (*A. serissa*).		
Tálí (*Dalbergia sissoo*).		
Der (*Zizyphus jujuba*).	Dera Ghází Khán.	
Mangoe (*Mangifera Indica*).		
Bukhain (*Melia sempervirens*).		
Pípal (*Ficus religiosa*).		

Name of tree.	Locality.	Remarks.
	Dera Ghazi Khan.	
Kachnar (*Bauhinia variegata*).		
Jál (*Salvadora oleoides*).		
Karíl (*Capparis aphylla*).		
Bhán (*Populus Euphratica*).		
Kíkar (*Acacia Arabica*).		
Ním (*Melia Azadirachta*).	Dera Ghází Khán.	
Kunda (*Prosopis spicigera*).		
Tamarisk (*Tamarix gallica and orientalis*).		
Jámu (*Sizygium jambolanum*).		
Gondí (*Cordia Rothii*).		
Girdnallí (*Cassia fistula*).		Wood for making Persian wheels (Local List).
	Peshawur.	
A table made entirely of Punjab woods, of which there are 132 specimens and 1863 pieces employed.		Capt. N. D. Garrett, R.H.A.
	Hazara.	
Déár, deodar (*Cedrus deodara*).		
Biár (*Pinus excelsa*).		
Fir or chír (*P. longifolia*).		
Tun (*Cedrela toona*).		
Súm, ash (*Fraxinus floribunda*).		
Walnut (*Juglans regia*).		
Barúngi, oak (*Quercus dilatata*).		
Dhaman (*Grewia oppositifolia*).		
Kangar (*Pistacia integerrima*).		
Dráwa (*Cedrela toona* var. *serrata*).		
Sissú (*Dalbergia sissoo*).		
Oak, rín (*Quercus incana*).		
Mulberry, tút (*Morus lævigata*).		
Yew, birmí (*Taxus baccata*).	Hazara Forest.	For fuel.
Sirras (*A. serissa*).		
Butkarar (*Celtis Caucasica*).		
Bankau (*Quercus annulata ?*)		
Phúláh (*A. modesta*).		
Karhá (*Acacia odoratissima*).		
Ebony, amlok (*Diospyros lotus*).		
Kálakát (*Prunus padus ?*)		Used for furniture.
Ber (*Zizyphus*).		For fuel.
Cinamon (*Cocculus laurifolius*, or more probably *Cinnamomum albiflorum*).		There is a specimen of th bark as a spice; it is wel flavored like cassia, &c.
Paluddar (*Picea Webbiana*).		
Kau (*Olea Europea*).		
Horse chesnut, bankhor (*Pavia Indica*).		

Name of tree.	Locality.	Remarks.
HAZARA.—*(Continued).*		
Manú (*Ulmus campestris*).	Hazara forest.	
Khair (*Acacia catechu*).		
Kaíń (*Ulmus campestris* or *erosa*).		
KAPURTHALLA.		
Sissu (*Dalbergia sissoo*).		
Palás (*Butea frondosa*).		
CHAMBA.		
Pinyát (*Cratægus oxyacantha*).	Chamba and Pangi.	Sent by RAJAH OF CHAMBA.
Wild pear, kaint (*Pyrus variolosa*).		
Chíl, fir (*Pinus longifolia*).		
Horned cherry, jamú (*Prunus padus*).		
Kanelú (*Ilex dipyrena*).		
Apple, chúí (*Pyrus*).		
Kílar (*Parretia Jaquemontii*).		
Khurg (*Celtis Caucasica*).		
Apricot, chír (*Armeniaca vulgaris*).		
Hazel (*Corylus lacera*).		
Rauns (*Cotoneaster obtusa*).		
Mundar (*Acer cultratum*).		
Crab ash, sandal (*Fraxinus xanthyloides*).		
Walnut (*Juglans regia*).		
Chínár (*Platanus orientalis*).		
Pencil cedar, devi diár (*Juniperus excelsa*).		
Olive kaú (*Olea Europea*).		
Peki (*Almus*).		
Edible pine, chilghoza (*Pinus Gerardiana*).		
Ráí (*Abies Smithiana*).		
Sunnú (*Fraxinus floribunda*).		
Tos (*Picea Webbiana*).		
Gúgú (*Pavia Indica*).		
Kilar, dyár (*Cedrus deodara*).		
Birch, búrj (*Betula bhojpatra*).		
Pear, naspátí (*Pyrus*).		
Wild pomegranate, anár (*Punica*).		
Kharak (*Celtis*).		
Paddam (*Prunus paddam*).		
Arna (*Amygdalus Persica*).		
Olive, kau (the specimen is like *Celtis*).		
Krún (*Morus serrata*).		
Budda, baida (*Salix*).		
Surja sanjad (*Elæagnus*).		
Pyák (*Alnus*).		
Soap nut, dodan (*Sapindus*).		
Gúń, chesnut (*Pavia indica*).		
Titrí (*Rhus acuminata*).		
Pajja (*Cerasus*).		

Name of tree.	Locality.	Remarks.
PATTIALA.		
Jáman (*Sizygium jambolanum*).		
Mulberry, tút (*Morus alba*).		
Bérí (*Z. vulgaris*).		
Tún (*Cedrela tuna*).		
Chíl (*Pinus longifolia*).		
Kelu (*Cedrus deodara*).		
Bans (*Bambusa stricta*).		
Am (*Mangifera indica*).		
Sisu, shísham (*Dalbergia sissoo*).		
Náwra (kismi túť), a kind of mulberry.		
Rasaunt (*Berberis sp*———).		
Walnut, akhrot (*Juglans regia*).		
Kíkar (*Acacia arabica*).		
Phuláhí (*A. modesta*).		
Frás (*Tamarix orientalis*).		
Lasúrah (*Cordia myxa*).		
Ním (*M. azadirachta*).		
Pípal (*F. religiosa*).		
WOODS FROM THE SIMLA BAZAR.		
Sál (*Shorea robusta*).		
Siriss (*Acacia speciosa*).		
Alpine oak, kharsu (*Quercus semacarpifolia*).		
Oak, bán (*Quercus incana*).		Sent by Dr. Cleghorn.
Ráí (*Abies Smithiana*).		
Himálayan spruce fir, moranda (*Picea Webbiana*).		
Sarv machla, leurí, twisted cypress (*Cupressus torulosa*).		

CLASSIFIED LIST OF WOODS, NATIVE OR GROWN IN THE PUNJAB.

[The uses and value of the fruit, flowers, leaves, fibre and bark of the trees, are not generally alluded to in the list, whose object is solely to enumerate the *woods* and trees, including also the shrubs which grow in the Punjab. The uses of the different parts will be found under their proper headings elsewhere.]

1809.—[1.] **Abelia triflora.**

Vern. Syn.—Chota búti (Murree).
Adai pashtawar (Pashtú).

1810.—[2.] **Abies smithiana.** Himalayan spruce.

Vern. Syn.—Rai.
Raiyang (Kanáwar).
Re, ro, rau (Sutlej).
Kachan or kachal (Hazára).
Rág (Lahaul).
Ré (Pangi).
Kaulí (Pangí).
Rao (Pangí).
Tos or tosh* (Chambá).

In the Murree Hills (Mochpúra), bauluddar, while *P. Webbiana* is called paluddar or palundar. The wood when under cover lasts pretty well, but is generally not much valued as it splits easily. It makes beautiful lathes. It grows plentifully at an elevation of 9 to 11,000 feet, and is often 100 feet high and 5 feet in diameter. This is sometimes called *Pinus Smithiana*. *Pinus morinda* and *P. khutrow* are mere varieties.† It is the least valued of all the Himálayan conifers.

1811. [3.] **Acacia arabica.**

Vern. Syn.—Bábul.
Kikar.

Wood dark brown, hard, tough and often crooked. It is most extensively used for agricultural implements, makes excellent tent pegs, and except box and olive it is the best wood for cog-wheels, teeth of machinery, and blocking tackle. The tree, of which there are two varieties, is common in the plains of the Punjab; it is of rapid growth, requires no water, and is worthy of cultivation. It produces a useful gum, and its pods are a favorite food of sheep and goats. The bark is used for tanning and gives a reddish tinge to the leather.

1812.—[4.] **A. cupressiformis.**

Vern. Syn.—Kábuli kikar.

Is a variety of No. 3, so called from the upward growth of its branches, somewhat assuming the cypress form. This variety is commoner in the Shahpúr district than the foregoing. In the Gujrát and Jhilam district it is abundant. The traveller along the Grand Trunk Road between Rawalpindi and Gujrát may see them in numbers in the Jhilam district.

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* Tos usually indicates *Picea Webbiana*, and rai *Abies*: in Chamba it is reversed.
† *See* SMITH and HOOKER's "Introduction," p. 31.

1813.—[5.] **Adhatoda vasica.**

Vern. Syn.—Behikar.
Bhekar.

Though only a shrub, it is valuable, as yielding a good charcoal for gunpowder. Specimens of the wood may be got an inch in diameter. It is quite the characteristic plant of the Lower Hills.

1814.—[6] **Acacia catechu.** Catechu tree.

Vern. Syn.—Khair.

The timber of this tree is hard and tough, but small, and inferior to the last. Its growth is confined to the outer hills, bordering on the plains. The catechu of commerce, "kath," is obtained by boiling the chips. (*See* "Tanning Substances," Sub-class D.)*

1815.—[7]. **Acacia eburnea.**

Vern. Syn.—Kíkkarí.
Daddá (Salt Range).

1816.—[8.]. **Acacia elata.**

Vern. Syn.—Dún siris.
Baro.

The bark is white, the centre timber dark, close grained and heavy. Little of this wood is available. An excellent avenue tree of straight growth.

1817.—[9.]. **Acacia farnesiana.**

Vern. Syn.—Wiláyiti kikar.
Hanja (Pashtú.)

The wood resembles the bábul, but is very small. It exudes a good gum, the tree is introduced, not indigenous: a scent is extracted from the flowers in Europe.

1818.—[10.]. **Acacia julibrissin.**

Vern. Syn.—Shirin (Kanáwar).

1819.—[11.]. **Acacia leucophlæa.**

Vern. Syn.—Reru.
Gargúsa (Salt Range).
Kákohi (Hazára).

Grows in the rakhs of the Punjab; resembles the next species.

1820.—[12.]. **Acacia modesta.**†

Vern. Syn.—Phulahi or phuláh.
Pulosa (Pashtú).

The timber is hard and tough, but inferior to bábul; it is used for charcoal, ploughs and wheel-barrows. This is one of the characteristic trees of the Punjab, and grows readily in poor, sandy soils. It is an excellent hedge plant.

1821.—[13.]. **Acacia Jacquemontii.**

Vern. Syn.—Babúl.
Kikkari.

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* MAJOR MADDEN describes the process of manufacture in the Tarai, *vide* "Jour. As. Soc." June 1848, p. 565. DR. HOOKER also, *vide* "Him. Journals," I., p. 52.

† The Australian species *Acacia robusta* and *A. stricta* have been introduced at Madopúr from seeds obtained at Ootacamund.

A. speciosa, synonym of the following :—

1822.—[14.]. **Acacia sirissa.**

Vern. Syn.—Siriss.
Sirín (Punjabí).

The timber is dark brown and hard, but little used except as fuel. The siriss is a good avenue tree.

1823.—[15.]. **A. speciosa var. Mollis.** (*See* 23).

Vern. Syn.—Karhá (Hazára).

Timber good. It is met with occasionally as far as Chamba. Its bark is prized in tanning.

1824.—[16.] **Acacia stipulata.** *Acacia kangraensis* of Jameson.

Ver. Syn.—Sirín. | Lasrín (on the Kíshngangá).
Oi (Kangra).

Met with occasionally to the west of the Jumna. A fine tree, abounding in the Kangra valley.

1825.—[17]. **Acer cultratum and sterculiaceum.** Maple.

Vern. Syn.—Mandal, Maner* (Chamba). | Tí,án (Kanáwar).
Trekhan (Hazára).

These trees are very common in the woods about Murree: they are called "trikudna" or "trikanna." Wood not much esteemed. The knots are used for ornamental cups, which sell high in Tartary. Elevation, 9,000 feet.

1826.—[18]. **Acer lævigatum.**

Vern. Syn.—Karádlu (Kotgarh).

1827.—[19]. **Acer sterculiaceum.**

Vern. Syn.—Lá,úr (Kanáwar); or by the Kashmírís "tilpatra."

These names having allusion to the incised "three-pointed" leaves.

1828.—[20]. **Acer caudatum.**

Vern. Syn.—Mandal (Kúlú). Dr. Cleghorn.

1829. [21].—**Adelia serrata.**

Vern. Syn.—Dhanyálí (Rajauri).

Has a dark green leaf, and is used for holly.

1830.—[22]. **Ægle marmelos.**

Vern. Syn.—Bel.
Bil.

The wood is hard and durable. The astringent pulp of the fruit is a valuable remedy in diarrhœa.

1831.—[23]. **Albizzia odoratissima.**

Vern. Syn.—Kurmrú.
Búná (Kághán).

Very like the *Acacia speciosa.*

* Report on Forests of Western Himálaya, p. 148. The wood is spelt "munner," in the place referred to.

1832.—[24]. **Alnus nepalensis.** Himálayan alder.

Vern. Syn.—Kunch or koish. Ghujbai (Pashtú); also gira; both species of *Alnus*. | Nyú (Kanáwar). Shrol (Hazára). Piák (Pangi).

The timber of this tree is firm, hard and difficult to cut, of a pale, brownish-red color. It is used for gunpowder charcoal, but not for iron furnaces. The bark is useful in tanning. Other species noticed are *Alnus obtusifolia* and *A. nitida* (Sutlej); called "shrol" in Kaghán. In Chota Lahaul and on the Chenáb there are species of *Alnus*, called "piák" and "tsápú."

1833.—[25]. **Amygdalus persica.** Peach.

Vern. Syn.—Arú. Ghurghushtai or mandala (Pashtú). | Rek (Kanáwar). Chimnánú (Lahaul and the Chenáb). Arna (?).

Wood good, but not available in quantity.

1834.—[26]. **Andromeda ovalifolia.** Common *Andromeda*.

Vern. Syn.—Elyán or ayár. | Ratankát (Kaghán).

Wood moderately hard, of a reddish brown color, used for charcoal. Bark soft. Leaves injurious to sheep and goats. The tree grows at an elevation of 7,000 feet.

1835.—[27]. **Armeniaca vulgaris.** Apricot.

Vern. Syn.—Jaldárú (corrupted from the Persian "zard árú" *i. e.*, yellow peach). Chúí. Barzha (Kanáwar). | Hárí (Hazára). Chír (Chamba). Cher (Chenáb). Sárí.

It is called "chir" when wild, and "sárí" when grafted so as to bear fruit. Wood hard but rarely met with sound. It is used for doors in Chamba, and for making boards of books in Ladákh, which are often carved. Much esteemed in France for turning. The kernels yield an excellent oil. It flourishes at an elevation of from 7,000 to 13,000 feet. Cunningham (J. D.) says it does not ripen above Shalkar.

1836.—[28]. **Artocarpus integrifolia.** Jak tree.

Vern. Syn.—Dahu. Tí,ú (Hazára). | Barral (Hindústán).

Excellent timber of a yellowish color. Very scarce in the Punjab. One fine tree is in the garden at Amb. It is to be seen also above Shahpúr on Rávi (Stewart).

1837. [29].—**Arundinaria utilis.** Hill-bamboo.

Vern. Syn.—Nirgali or ringál. | Spyúg (Kanáwar).

Used for wicker work, shepherds' pipes, mats, &c.

1838.—[30]. **A. falcata.**

Vern. Syn.—Garu.

The smallest bamboo, and the one which grows at the greatest heights.

1839.—[31]. **Azadirachta indica.**

Vern. Syn.—Ním (*Melia azadirach*).

Hard, heavy wood; only found in the East Punjab. The leaves are useful as an astringent, and the seeds afford a valuable bitter oil.

1840.—[32]. **Balanites Ægyptiaca.**

Vern. Syn.—Hinggo (Rohtak collection, 5015).

Used for fuel only: does not occur except in the eastern part of the province.

1841.—[33]. **Bambusa stricta,** and **B. arundinacea.**

In the Simla collection. "Nál bans" is the hollow stem, "maggar báns" the solid. The varied uses of this valuable plant are admirably described by MAJOR DRURY, some extracts from whose account follow:—

"Of it are made implements for weaving; the posts and frames of the roofs of huts; scaffoldings for buildings; portable stages for native processions; raised floors for granaries; stakes for nets in rivers; rafts, masts, yards, oars, spars, and boat decks. It is used for building bridges across creeks; for fences; as a lever for raising water for irrigation; and for flag-poles. Several agricultural implements are made of it; as are also hackeries or carts, doolies or litters and biers; the shafts of javelins or spears, bows and arrows, clubs and fishing rods. A joint of bamboo serves as a holder for pens, small instruments and tools. It is used as a case in which things of little bulk are sent to a distance; the eggs of silk-worms were brought in a bamboo cane from China to Constantinople, in the time of JUSTINIAN. A joint of bamboo answers the purpose of a bottle; and a section of it is a measure for solids and liquids in bazars. A piece of it is used as a blow-pipe, and as a tube in a distilling apparatus. A small bit of it split at one end serves as tongs to take up burning charcoal; and a thin slip of it is sharp enough to be used as a knife in shelling betel nuts, &c. Its surface is so hard that it answers the purpose of a whetstone, upon which the ryots sharpen their bill-hooks, sickles, &c. Cut into lengths and with the partitions knocked out, the stems form durable water-pipes, or by a little contrivance are made into excellent cases for holding rolls of papers; slit into strips they afford a most durable material for weaving into mats, baskets, window blinds, and even the sails of boats."

In the Punjab there are 4 species of bamboo, *B. stricta* being indigenous in the Salt Range.

1. Báns, the hollow large bamboo *(Bambusa arundinacea)*; cultivated in the lower Hills, &c.

2. Bar, solid bamboo of the Lower Hills, used for spear handles and sticks *(B. stricta)*.

3. The "nirgali" or small bamboo of the Hills, growing at elevations of from 5 to 8,000 feet *(Arundinaria utilis)*.

4. The "garu," or still smaller bamboo, growing at great elevations, probably up to 12,000 feet *(Arundinaria falcata)*.

1842.—[34]. **Bassia latifolia.**

Vern. Syn.—Mauwa.

A good and durable wood, but small, and not abundant in the Punjab. It is worthy of introduction as an avenue tree. A thick, fatty oil is obtained from the seed. The timber is hard and strong, and is in request for naves of wheels, carriages, &c. BARNES describes it as abundant in parts of the Núrpúr perganah of the Kangra district, where the two small talúkas of "Man" derive their name from the prevalence of the tree. A spirit is distilled from the flowers, which are steeped in water and allowed to ferment. The flowers sell at 50 seers the rupee for this purpose.* The flowers are sweet-tasted, and are eaten raw. Jackals are particularly fond of them.

1843.—[35]. **Bauhinia acuminata.**

A very beautiful flowering shrub, it is easily distinguished from the others by having the apex of each lobe of its leaf pointed (hence its name) instead of round like the others.

1844.—[36]. **Bauhinia variegata (var. Purpurea).**

Vern. Syn.—Kairwál.

* Settlement Report of Kangra District, sec. 149.

Heart wood is of a dark color, and very hard, but too small to be of much use.

1845.—[37]. **Bauhinia variegata.**

Vern. Syn.—Kachnár.
Kuleri or kalár (Rawalpindí).
Karár (Hushyarpúr).
Kalyár or kalár (Hazára).
Kolá (Salt Range).

Very like the above.

1846.—[38]. **Bauhinia racemosa.** (*B. Vahlii*).

Vern. Syn.—Máljún.
Taur (Hill name).

This gigantic climber affords a strong rope fibre. The seeds are eaten. The huge seed vessels look like the soles of shoes or thick pieces of brown rough leather. When ripe they are placed over the embers of a fire till cooked, when they split open and the flat seeds are found inside: each seed has an envelope of bitter skin, which is removed; the remaining kernel is very palatable.

1847.—[39]. **Benthamia fragifera.**

Vern. Syn.—Tharnel.

The wood is small. Fruit edible, and is used as a preserve. Elevation, 6,000 feet.

1848.—[40]. **Berberis aristata, and other species.** Berberry.

Vern. Syn.—Rasaunt (Hindústání).
Kuraskai (Pashtú).

B. lycium grows at elevation 3,000 to 9,000 feet; and *B. aristata*, elevation 6,000 to 10,000 feet. In the Murree Hills this shrub is called "sambal" or "súmlú, or "sūmlú" (Hazára): its fruit is dried for currants, "zirishk" (tursh), and its yellow juiced root and wood yield the extract called "ras," "rasaunt" or "raswal." Wood too small to be of much use, except for fire-wood.

1849.—[41]. **Betula bhojputra.** Birch.

Vern. Syn.—Burj.

At Pangi "bhúj," and over most of the Hills, except Basáhir, where it is called "bhojpatra;" "shák" or "shág" (Kanáwar); "tagpa" (Lahaul). Wood good: used for cups, common turnery, and for fuel by travellers in the higher ranges. It grows at elevations from 10,000 to 13,000 feet. The bark peels off in large sheets, and is used for umbrellas, for writing upon, and for the flexible tubes of húkas. Every consignment of the ornamental papier maché ware of Kashmír reaches the Punjab packed in wrappers of birch-bark. The houses in Kashmír are often roofed with it.

1850.—[42]. **Bignonia suaveolens.**

Vern. Syn.—Pádal or sammú.

Wood elastic and long grained: used for buggy shafts, plough yokes, &c., in Dehra Dhún and Kangra.

1851.—[43]. **Bignonia suberosa.**

Vern. Syn.—Akás ním (introduced only).

The wood is soft, and used for firewood, the bark very cork-like. It is a handsome tree, growing with great rapidity, and sending out numerous suckers, from which it may be easily raised.

1852.—[44]. **Bergera Kœnigii.**
Vern. Syn.—Gárdala (Kangra).
Gándla.

Bignonia undulata, *See* **Tecoma undulata.**

1853.—[45]. **Bignonia indica (Calosanthes Indica).**
Vern. Syn.—Tat palanga (Hushyarpúr).
Loose grained and bad wood, easily decaying.

1854.—[46]. **Bombax heptaphyllum.** Cotton tree.
Vern. Syn.—Sembal or semal.
The wood of this tree is soft, but stands well under water. It grows rapidly, and is occasionally found 30 to 40 feet in girth. The tree is sometimes called *Pentaphyllum*, when the lobes of the leaves are 5 instead of 7, but there is no difference in species, for these trees frequently carry both kinds of leaf. When the trees grow very large, their appearance is magnificent, the thick stem spreads out towards the base, at intervals into buttress-like projections, as if these had been added for the purpose of strengthening or supporting the main stem. In the spring season, the tree is covered with huge magnolia-shaped scarlet blossoms, and the seed vessel when ripe yields a short-stapled fluffy cotton, used only to stuff pillows. The young tree and branches have short flat thorns. The tree is the "shálmali" of Sanscrit authors. The young flower buds are cooked and eaten in some places.

1855.—[47]. **Boswellia glabra.**
Vern. Syn.—Salhi.
This tree is very rare to the west of the Jumna. It yields the odoriferous gum resin called "gúgal."

1856.—[48]. **Bignonia suaveolens.**
Vern. Syn.—Sammí.
Good wood, not common.

1857.—[49]. **Buddleia crispa.**
In Waziristán "spera wana" (Pashtú); called "dhúrú" about Chamba; and "chitta búti" (Murree, &c.)

1858.—[50] **Buchanania latifolia.**
Vern. Syn.—Chiraulí.
Dhan.
Common for some distance west of the Jumna, in the Lower Hills.

1859.—[51]. **Butea frondosa.**
Vern. Syn.—Dhák, palás.
Chichrá or chachrí (Rawalpindi).
The timber is tough but not durable, and is used extensively for fire-wood. Excepting stray specimens, it is not found south of Lahore or west of Rawalpindi. The flowers, "kesu," are used as a dye. The tree exudes an astringent gum, called East Indian kino (kamarkas). Large quantities of the leaves are brought into Lahore every day. They serve as dishes and plates, or as wrappers, in which the bunyas and sweetmeat sellers deliver their wares—as sugar, atta, curds, &c., &c. They sell at one or two pice per seer.

1860.—[52]. **Buxus sempervirens.** Box.

Vern. Syn.—Shamshád. Páprang or chikri (Kanáwar). | Papér (Jhilam). Pápri and pappar (Salt Range).

Wood hard, heavy, and nearly as compact as the box-wood of Europe. It grows at an elevation of 6,000 feet. Used in the Schools of Art throughout India for wood engraving. It is in demand for plugs for Minie rifle balls, and at the Medical Store at Sealkot it is turned into pill boxes; it is useful for trenails and wedges. The wood is liable to split in the hot weather, and should be seasoned, and stored under cover. Found in the valleys of Sutlej, Parbati, and near Dharmsalla, and in the Salt Range; sometimes attains a girth of 20 inches, or more.

"The Himálayan box appears to be identical with the tree common all over South Europe, from Gibraltar to Constantinople, and extending into Persia. It is found chiefly in valleys, at an elevation of from 3 to 6,000 feet. I have met with it from Mount Tira near Jhilam to Wangtú bridge on the Sutlej. It is variable in size, being generally 7 to 8 feet high, and the stem only a few inches thick, but attaining sometimes a height of 15 to 17 feet, as at Manikarn in Kúlú, and a girth of 22 inches as a maximum. The wood of the smaller trees is often the best for the turner and wood engraver. It is made into little boxes by the villagers for holding ghí, honey, snuff and tinder.

"The olive "zaitún," (and kau) which has also been tested for wood engraving at the Madras School of Arts, is another plant of the Mediterranean Flora, which range from the coast of the Levant to the Himálaya. It varies a good deal in the shape of its leaves and in the amount of ferruginescence, hence the synonyms *cuspidata* and *ferruginea;* but it does not appear to differ specifically from the *Olea Europea* (Mount of Olives), the emblem of peace and plenty. The finest specimens I have seen are in the Kaghán and Peshawur valleys, where the fruit resembles that of rocky sites in Palestine or Gibraltar. The wood is much used for combs and beads—and is found to answer for the teeth of wheels at the Madhopúr workshops."

1861.—[53]. **Cæsalpinia sepiaria.**

Vern. Syn.—Phalwaí (Hazára and Murree).
U'ru, urní (Kághán, &c.)

1862.—[54] **Calotropis procera.**

Vern. Syn.—Ak. Madár. | A'k (Hindústán) Spulmei (Pashtú).

Not a regular wood, but a specimen of sufficient size was sent for exhibition to warrant its insertion (*See* under "Fibres," &c.)

1863.—[55]. **Callicarpa incana.**

Vern. Syn.—Putharman (Murree Hills).

Common in low Hills: a shrub.

1864.—[56]. **Calligonum polygonoides.**

Vern. Syn.—Phog.

The wood is small. The flowers called phoglí are eaten.

1865.—[57]. **Capparis aphylla.** Leafless caper.

Vern. Syn.—Karíl. Karír. | Kirra (Pashtú)

Yields a hard wood which is used for turning, and rafters in some places: white ants will not

touch it; it is also a good fire-wood, burning even when green. The fruit is eaten, both raw and preserved; and the young flower buds are preserved as a pickle—the fruit causes, when eaten largely, severe constipation.

1866.—[58]. **Capparis spinosa.** European caper.

Vern. Syn—Bassar (Kanáwar, along the Sutlej).
Kebarra (Pashtú).
Kaur, kerí (Salt Range).

Abundant in the Salt Range and Lower Himálayan formations and elsewhere on limestone soil. The wood is very small. It is probable that the carob tree (*Ceratonia siliqua*) would succeed well in places where *C. spinosa* grows. In the island of Malta, with dolomite limestone soil, both trees flourish profusely.

The *Ceratonia siliqua* has been tried at Madhopúr, and other places and succeeds fairly well: one tree in Lahore has given fruit, but most of the larger ones are males.

1867.—[59]. **Careya arborea.**

Vern. Syn.—Khúmbi.

Wood of little use. The tree is not often met with in the Punjab, either wild or cultivated; the bark serves as cordage, and is used for slow matches.

1868.—[60]. **Carissa diffusa.**

Vern. Syn.—Garna.
Garnnda (Murree hills).

In Rawalpindi collections, Kangra, and passim. In the plains, to a little way from the outer Hills.

1869.—[61]. **Carissa edulis.**

Vern. Syn.—Karonda.

The wood of this shrub is only used as a fuel. It is common in Kangra, cultivated in the Plains, and the fruit is made into an excellent jelly. Elevation from 3,500 to 5,000 feet.

1870.—[62]. **Carpinus viminea.** Himalayan hornbeam.

Vern. Syn.—Chamkharak.

The wood is hard and heavy, and is esteemed by carpenters. The tree is rare in the Punjab, and is perhaps not found west of the Sutlej. Elevation, 5,500 feet.

1871.—[63]. **Casearia tomentosa.**

Vern. Syn.—Chílah (Kangra, &c.)

A large shrub: the seeds used for poisoning fish.

1872.—[64]. **Cassia fistula.**

Vern. Syn.—Kanyár or amaltás.
Girdnalli (Dera Ghází Khán).

The wood is small and often crooked. It is plentiful in the outer hills of the Punjab. The bark is used for tanning. The tree is very ornamental in the spring season from its beautiful drooping yellow flowers, which far surpass the English laburnum. Dr. Stewart* remarks that, "its timber is worthless, very brittle, and peculiarly liable to the attack of insects."

* Bijnore Forest and its Trees.

1873.—[65]. Casuarina equisetifolia. Beef-wood (introduced).

The timber is so hard and tough that it damages native tools. It is an excellent wood for piles and posts, bears a great strain, and is said to last well under water. This tree was introduced a few years ago from Arracan, and is now cultivated at Lahore, Jálandhar and Madhopúr, &c. It prefers a sandy soil, and is of straight and rapid growth. It is very well suited for canal and railway plantations. *Casuarina muricata* and *Casuarina torulosa*, have been introduced at Madhopúr and other places.

1874.—[66]. Cedrela toona. Toon tree.

Vern. Syn.—Tún.

This wood is hard and durable, of a reddish color, and is the best furniture wood in Northern India. The Jaswan Dhún was once famous for toon-wood, but few trees are left. It grows along the outer hills as far west as Hazára, and ought to be extensively planted on the banks of canals and water-courses. Elevation, 3,000 to 6,000 feet. It is not very easy to raise, but thrives afterwards in the Plains. It succeeds admirably at Delhi, and many other places.

1875.—[67]. Cedrela toona, var. Serrata. Hill toon.

Vern. Syn.—Darl or darli (on the Sutlej and Beás.
Dimri, drawa or dráb (Hazára).
Khishing or khanam (Kanáwar).
Der (Chenáb and Chota Lahaul).

Like some other open grained woods, it resists water well.

The wood is open grained, lighter in color and inferior to the last. It is common in the Murree Hills, where the real tún hardly grows at all, except in one or two places. The tree is easily distinguishable by the immense size of its serrated or pinnate leaves, which hang in graceful clusters like a palm tree. I measured an ordinary leaf, and found it 30 inches long, having 15 pairs of leaflets, opposite and flat, all except the 4 end leaflets, which are usually turned in a direction transverse to the rest. The tree is more distinguished by its long racemes of flowers.* This is the "túní" of the carpenters of the plains.

1876.—[68]. Cedrus deodara. Deodar or Himálayan cedar.

Vern. Syn.—Diár, paluddar (Hazára and Kaghán).
Palürr (Chilás).
Kelú, kelí, keorí (Kúllú and Béas).
Deodar, diár (Kashmír).
Kalain, kilaí (towards the Dhauládár range).
Kelú, kelí, kilár, dadá, diár, kálon (Chamba, Chenáb and Rávi).
Kelú, kiáli, kaiwal, kelmang (Basahír, Kanáwar, &c).
Gyam (Thibet).
Deodar or diár (Kamaon and Garhwál).
Nashtar† (Persian and Pashtú).

The most valuable wood of the Punjab Himálaya, very durable, and easily worked, of a yellowish color, straight grain, and fragrant with resin, which preserves it from insects. It grows at an elevation of from 6,000 to 8,000 feet. The deodar forests of Chamba and Basahir, and the Kashmír territory, are of great value. The tree often attains a height of 100

* Dr. Cleghorn.

† Nashtar is a Persian word, the only one in the language for all kinds of pines from the chil upwards. It is imported into the Pashtú language.

to 120, sometimes over 200 feet, and a girth of 20 to 25 feet; one large one having been measured of 42 feet in circumference close to the base. It is now supposed to be identical with the Cedar of Lebanon. *

Celastrus spinosa. (See *Gymnosporia*).

A mere shrub. Some parts of the Lower Hills. This and the following are now known to be the same as *Gymnosporia spinosa.*

1877.—[69]. **Celastrus parviflora.**

Vern. Syn.—Sur-aghzai (red thorn; in Pashtú).

1878.—[70]. **Celtis Caucasica.** Nettle tree.

Vern. Syn.—Karrak or kirki (Kangra).
Kar (Kanáwar).
Kargam (Pangi).
Tághun or takpun (Pashtú).
Wathamman (Salt Range).
Batkar (Murree Hills).
Kúrg (Pangi, &c.)

The timber is rather soft and used for fire-wood. It is a large rapid growing tree, common in the hills. Its bark is used as cordage. There is a *Celtis*, called "nuni," in the Kangra valley.

1879.—[71]. **Celtis eriocarpa.**

Vern. Syn.—Koo.

The bark used for making shoes. Grows at 6,000 feet.

1880.—[72]. **Celtis Nepalensis.**

A sample of the wood (5262) from the Murree Hills, is in the Rawalpindi list, by the name of "batkar."

1881.—[73]. **Cerasus puddum (Prunus puddum).** Bird-cherry.

Vern. Syn.—Paddam.
Chumyárí (Murree Hills).
Amalgúch (Kaghán, STEWART).
Pájá (Kotgarh).

Wood hard and close grained, of a reddish color, procurable 15 to 20 inches in circumference, occasionally used for furniture, and makes excellent pipe-sticks. It is found as far west as the Indus. The fruit is sold in Simla bazar. It grows at from 3,000 to 7,000 feet. The *Cerasus communis,* a congener of this, probably yields the "gílás," or Kashmír cherry, and the "árubálú" or Kábul cherry.

Cerasus cornuta (Prunus padus). Bird cherry.

Vern. Syn.—Jámuna.
Páras (Kaghán):

(See *Prunus padus*).

1882.—[74]. **Cinnamomum albiflorum.**

Vern. Syn.—Dárchíní.

* The principal alleged difference, viz., that the cones of the cedars are persistent, and those of the deodar deciduous, is founded on error. The difference between the resinous qualities, color, and hardness of Lebanon cedars grown in their native places and in England, appears quite as great as the difference between the Lebanon cedar and the deodar (*see* HOOKER and THOMSON'S "Introductory Essay," p. 31. Any one wishing to study the details of deodar growth in the hills, should study DR. STEWART'S "Chenab and Ravi Forest Report," published as a Supplement to "Punjab Gazette," 20th Sept., 1866, and DRS. BRANDIS and STEWART'S Report on the Deodar of Bashahir Forests (1865).

A small quantity grows in Bakot, Hazárá. The wood is of a reddish color, and the bark pleasant flavored, and is in fact Cassia or Cinnamon (5440). The tree is rare in Chamba.

1883.—[75]. **Citrus aurantium.** Orange.

The timber is hard, but not available in quantity, as the tree is scarce, and so much valued for its fruit.

1884.—[76]. **Colebrookia oppositifolia.**

Vern. Syn.—Basoti (Kangra).

Abundant at lower heights, and the Himálaya, &c. Wood used for gunpowder charcoal.

1885.—[77]. **Conocarpus latifolius.**

Vern. Syn.—Dhao (Kangra, &c.) Kúládhán. | Chál (Cis-Sutlej).

Called "chál" towards the Jumna. Yields a good, hard, strong timber; makes fine buggy shafts, and scabbards for swords (JAMESON). It is common in the Kangra valley, but of small size; also in all the Lower Hills to some distance west of the Jumna.

1886.—[78]. **Cordia angustifolia (Suboppositifolia).**

Vern. Syn.—Gondi.
Gondní.

A small tree. Wood tough; used for making carriage poles. Not uncommon: planted in the Plains.

1887.—[79]. **Cordia myxa.**

Vern. Syn.—Lasúra.

Wood soft but good for fuel. Common: planted in the Plains. The tree attains a considerable size in Kangra and Hushyarpúr.

1888.—[80]. **Cordia Macleodii.**

There is one tree of this in the province. It was introduced from Central India. Its wood approaches teak in its properties.

Cordia vestita. (See *Gynaion.*)

1889.—[81]. **Coriaria Nepalensis.**

Vern. Syn.—Gúch.
Tadrelú, balel (Kashmír).
Líchakhro, armúra, phaphar chor; &c. (Kangra).
| Kanile, padára (Rávi).
Shere (Kanáwar).

Wood of small size, very prettily grained.

1890.—[82]. **Cornus macrophylla.** Dog-wood.

Vern. Syn.—Haleo.
Kágshi (Sutlej valley CLEGHORN).
Kandar.
| Kandrú (Kághán, &c.)
Shtá or shká (Kanáwar).
Harrú (Chenáb).

Wood hard but small, and not available. Grows at an elevation of 7,000. Its charcoal is used in making gunpowder.

1891.—[83]. **Cornus oblonga.**

Vern. Syn.—Bakár (Cis-Sutlej, Kalesara, &c.)

A small tree, occasionally in the outer hills in the east of the Punjab.

1892.—[84]. **Corylus lacera.** Hazel.

Vern. Syn.—Tángi, thangoli (Chenáb, &c.)	Geh (Kanáwar).
Bankimu (Sutlej valley, CLEGHORN).	Urní (Kághán).

Timber elastic but small; used in making rings for coolies, hoops, walking-sticks, &c. Elevation, 8,000 feet.

1893.—[85]. **Corylus colurna.**

Vern. Syn.—Jhanji (Kúlú).

A good sized tree. Called "sharoli" on the Parbati river (CLEGHORN).

1894.—[86]. **Cotoneaster baccillaris.** Indian mountain ash.

Vern. Syn.—Rauns.	Lún or lúni (Murree Hills).
Kharwé (Pashtú).	

A hard, heavy, close-grained wood. Excellent for alpen-stocks, and seems suitable for turning. Elevation, 8,000 to 10,000 feet.

1895.—[87]. **C. rotundifolia.**

Vern. Syn.—Khiroba (Pashtú), Waziristán (DR. STEWART).

1896.—[88]. **C. obtusa.**

Vern. Syn.—Síchú, jalidar (Salt Range).

1897.—[89]. **Cratægus crenulata.** Whitethorn.

Vern. Syn.—Gengáru.

Wood very strong, but small. Used for making sticks. Elevation, 3,000 to 7,000 feet.

1898.—[90]. **Cratægus oxyacantha.**

Vern. Syn.—Ghwardza (Pashtú).

Ban sinjli or sinjli (Kághán).	Pingyàt or pinyát (Chenáb and Ráví).

Not uncommon in various parts of the Himálaya at 5 to 9,000 feet. Fruit not unpalatable.

1899.—[91]. **Cratæva religiosa.**

Vern. Syn.—Barna.

The wood is rather soft, and is used for carving models. The tree attains a large size in alluvial soil. The mucilage of the fruit furnishes a cement.

1900.—[92]. **Cupressus sempervirens.**

Vern. Syn.—Sarú (sarv).

The wood is remarkably durable, but the tree flourishes only when cultivated, in the Punjab.

1901.—[93]. **Cupressus torulosa.** Twisted cypress.

Vern. Syn.—Deodara (Kúlú and the Béas).	Leuri (east of Sutlej).
Devidiár (Chenáb and Ráví).	Ne,ur (in Kotgarh list).
	Galla, gallain or kallian (Sutlej).
	Súraí (Kamaon).

This tree produces a useful, yellowish, exceedingly fragrant wood, but it is scarce in the Punjab Himálaya, and also sparingly on the Rávi. It occurs near Simla, on the Parbati, in the Upper Beás valleys.* It has been found most valuable for roofing and other purposes at Nynee Tal. Its elevation is from 6,000 to 8,000 feet.

1902.—[94]. **Cydonia vulgaris.** Quince.

Vern. Syn.—Bhí or Bihí.

Grows in great abundance at Nagar in Kúlú (Cleghorn); and not uncommonly elsewhere, cultivated. The seeds are used as a medicine, called *bíhí dána*.

1903.—[95]. **Dalbergia Ougeinensis (Ougeinia dalbergioides).**

Vern. Syn.—Sandan.

The wood is hard: used for wheels and helves of axes, but it is a small tree, and scarce in the Punjab. It occurs occasionally in the Lower Hills as far west as Rajaori, beyond the Chenab.

1904.—[96]. **Dalbergia robusta.**

Wood hard. This tree is not known to grow wild in the Punjab, but it is worthy of introduction.

1905.—[97]. **Dalbergia sissoo.** Sissú tree.

Vern. Syn.—Shísham or táli.
Shawa (Pashtú).

Shísham wood is hard, strong, tenacious and compact, and is the best hard-wood of the Punjab. Its great durability renders it one of the most valuable timbers in India. It is used for gun-carriages, furniture, agricultural implements, and is well suited for railway sleepers. It is a tree of great beauty and rapid growth, and is reared with facility, early attaining a good working condition of timber. It cannot be too extensively planted throughout the Punjab.

1906.—[98]. **Daphne oleoides.**

Vern. Syn.—Kuttí or kutilál (Murree Hills, Hazára, and elsewhere).
Zhíkak (Kanáwar).
Laghunai (Pashtú).

Its chief value is for its bark (*See* under Fibres, Class IV., Sub-class E.)

The wood is hard and white. *D. cannabina* is another species, called niggi (Béas), jekú (Sutlej), sannarkat (Hazára and Kashmír).

1907.—[99]. **Desmodium tiliæfolium.**

Vern. Syn.—Chamkát (Murree Hills).
Kalanchi.

The bark is also a paper making material, and the tree grows to a larger size than the last-mentioned: the wood is close-grained, and a pale whitish yellow.

1908.—[100]. **Desmodium argenteum.**

Vern. Syn.—Múss (Kanáwar).

Chiefly on the Sutlej. Very strong temporarary ropes made from its bark.

1909.—[101]. **Desmodium sp——?**

Vern. Syn.—Múrb (Sutlej valley).
Brí and kathi (Kúlú), (Cleghorn).

* Cleghorn's "Report on the Forests of the Western Himálaya," p. 74.

1910.—[102]. **Deutzia staminea.**

Vern. Syn.—Phul kanri (Hazára). Phurilí (Kashmír). | Sai (Chamba). Arúchí, deús (Bassáhir).

A small sized wood, white and close-grained.

1911.—[103]. **Diospyros lanceolata.** Hill ebony.

Vern. Syn.—Tendú or tindú.

Timber good, but scarce.

1912.—[104]. **Diospyros lotus.**

Vern. Syn.—Amlok or málok (Kaghán).

In parts of Hazára the male plant is called "gwalidar," and the female "amlok." Timber good, but only available in Hazára, where it is known and valued chiefly for its fruit, which is purple in color, and about the size of a pigeon's egg: it is eaten either fresh or dried.

1913.—[105]. **Diospyros montana.**

Vern. Syn.—Hírak or hirek (Hushyarpúr).

A small tree: not common in the Punjab.

1914.—[106]. **Diospyros tomentosa.** Hill ebony.

Vern. Syn.—Mitha tendú.

The wood is hard and heavy, of a dark brown or black color, but the tree is rare in the Punjab.

1915.—[107]. **Dodonæa Burmanniana.**

Vern. Syn.—Sanatta or santá, alyár (Rawalpindí, also Salt Range). | Mírandú (Kangra). Ghuraskai or wuraskai (Pashtú).

The wood is very tough, of a white color, and is used for carving. Grows abundantly in the Lower Hills, and in the Plains when cultivated. It is a good hedge plant. There is another species of *Dodonæa*, with broad leaves, growing in the Badámí Bágh of Lahore.

1916.—[108]. **Ehretia aspera.**

Vern. Syn.—Chamror. Púna (Rawalpindí, Kághán, &c.) | Lor (Pashtú). Saggar, baddí kánder (Salt Range).

Yields a good but small timber. Not uncommon to Trans-Indus.

1917.—[109] **Ehretia serrata.**

Similar to the last, not uncommon in the lower Himálaya.

1918.—[110] **Eleagnus conferta.**

Vern. Syn.—Gehai or gawái, or rúl (Sutlej valley). Rinsot (Kanáwar). | Sanjatá (Pashtú). Kalkoli or kankol (Kaghán).

The wood is small, and somewhat resembles *Cratægus* in its qualities. The fruit is edible, and called "sanjad."

1919.—[111]. **Elæodendron Roxburghii.**

Vern. Syn.—Jamoa.

Rare in the Lower Hills west of the Jumna. The wood is not valued.

1920.—[112] **Emblica officinalis.**

Vern. Syn.—Aoṅla.
Amlá.

The timber is hard, of a nut-brown color, and is good for making boxes. The fruit is very acid. Common wild in outer Hills, and cultivated occasionally in the Plains.

1921.—[113] **Erythrina stricta.** Coral tree.

Vern. Syn.—Dhol dák. | Anashtar (Plains).
Bartho (Hills).

The wood is white and soft: used for scabbards and for "chalnis," or sieves. Cultivated in the Plains and wild in outer Hills.

1922.—[114]. **Eriobotrya japonica.** Loquat.

Vern. Syn.—Lukát.

Cultivated only as a fruit tree in gardens.

Eugenia jambolana. *See* **Sizygium.**

1923.—[115]. **Euphorbia Royleana.**

Vern. Syn.—Chún.
Thóhr.

This grows much in the Lower Hills wild, and on the Plains as a hedge plant. It frequently attains to a considerable height. I have seen specimens from 20 to 30 feet high, and I believe still larger ones might be found. When old the stem contains a regular, though loose and fibrous wood; the wood has at its centre a formation of pith in parallel cells or layers. This central axis always retains the original pentagonal or hexagonal form, although the whole stem has lost it through age and growth. Dr. Henderson informs me that the leafless *Euphorbia* often has a stem 18 inches in diameter, and that it is used for fire-wood.

1924.—[116]. **Euonymus fimbriata, or E. Hamiltonii.**

Vern. Syn.—Síkhí (Murree, &c.). | Battal.
Barphulí (Kághán). | Pápar.

Wood hard and useful, and beautifully smooth and white.

1925.—[117]. **Eucalyptus.**

Several species have been introduced and are growing well in the Agri-Hort. Society's Garden: as yet they can be hardly called Punjab woods. There are a number of these trees growing at Madhopúr over 60 feet in height.

1926.—[118]. **Falconeria insignis.**

Vern. Syn.—Lodhar (Kangra).

1927.—[119]. **Feronia elephantum.** Wood apple.

Vern. Syn.—Kait.

Yields a strong, heavy wood, which is however not procurable in any quantity in the Punjab. A gum somewhat like gum arabic is obtained from the ripe fruit.

1928.—[120]. **Ficus caricoides.**

Vern. Syn.—Anjíri. | Kak or kok (Kanáwar).
Phagwárí. | Kuwári or puári (Kaghán).
Indzar (Pashtú.) | Phág (Kaghán).

A specimen of this wood (4999) was sent from the Delhi district. Common in the Himálaya, and fruit occasionally excellent.

1929.—[121]. **Ficus glomerata.**

Vern. Syn.—Gúlar (Hindustání). Rúmar or rúmal (Kangra). | Palák (Salt Range).

Timber soft: called "glomerata" on account of the fruit, which gathers in clusters on the trunk at the branch joints.

1930.—[122]. **Ficus indica.** Banyán (this name is not used in Punjab).

Vern. Syn.—Bar or bargat. Bór.

The wood of all the *Ficus* family is soft, and seldom used except for fire-wood. *Ficus indica* and *Ficus religiosa* are not allowed to be cut by villagers. The leaves afford valuable food for camels. The aerial roots were much used by the Sikhs for making slow matches for their matchlocks. The roots are beaten to separate the bark, and the fibres are twisted into a match and dried. The roots of *Acacia modesta* were similarly used, and elm bark in the Hills.

1931.—[123]. **Ficus oppositifolia.**

Vern. Syn.—Dhúra (Kangra, &c.)

1932.—[124]. **Ficus Roxburghii (macrophylla).**

Vern. Syn.—Timbal. Trimbal (Kangra). Thossa. | Phedu or ferú (in Chamba List). Rumul (Kaghán).

The fruit is sold in the bazar of Simla, and has a pleasant flavor. The tree grows at a height of 5,000 feet.

1933.—[125]. **Ficus religiosa.**

Vern. Syn.—Pípal.

1934.—[126]. **Ficus venosa.**

Vern. Syn.—Pilkan (Hindústání). Kahimmal (Salt Range).

Not uncommon: wild at low elevations in Hills.

1935.—[127]. **Flacourtia sapida.**

Vern. Syn.—Kangi. Kandai. | Kuké (Murree Hills). Kakú (Salt Range).

Common, chiefly in outer Hills.

1936.—[128]. **Flacourtia sepiaria.**

Vern. Syn.—Sharáwani (Dera Ismaíl Khán). Dajkar, jidkar (Salt Range).

Its thorny branches make good fences. It is common in the Salt Range.

1937.—[129]. **Fothergilla involucrata (Parrotia Jacquemontiana).** Witch hazel.

Vern. Syn.—Kílar (Pangi). Pasér or pasérí (Hazára), or pishor (Kághan, &c.) | Po (Kashmír). Spilécha (Pashtú). Shá (Kanáwar).

Wood hard and tough, used for pegs, and in-door work. The tree is common in Kashmír and

Chamba, but is of small size; it is used in Pangi, and wherever it grows, for the suspension twig bridges, called "jhúlas."

1938.—[130]. **Fraxinus floribunda.** Large ash.

Vern. Syn.—Sannan.
Sunnu, súm (Hazára and Kangar ?)

Is an excellent, strong, tough, elastic wood, like English ash. Only found in Hazára, especially in the Mochpúra and Thandiání ranges, and Pangi; and not abundant there.

1939.—[131]. **Fraxinus xanthoxyloides.** Crab ash.

Vern Syn.—Hanóch (Hazára).
Sargal (Pangi).
Thúm (Basáhír).
Hagai (Pashtú).
Kanóch (Kúlú), (Cleghorn).
Shillí and bará chur (Kishnganga river).
Núch (Kághán).

A good elastic wood of small size. Suited for staves, jampan poles, walking sticks, and for ploughs in Kághán. Grows at a height of 5 to 7,000 feet.

1940.—[132]. **Gardenia tetrasperma.**

Vern. Syn.—Kurkuní, túlikukar (Hazára).
Bandaru, pūtkanda, dárú, bákshí (Kangra).
Jirndú (Rávi).
Bisindidi (Chenáb).

A mere shrub.

1941.—[133]. **Garruga pinnata.**

Vern. Syn.—Kharpat (*i. e.*, grass leaf).

The foliage is used as fodder. Its bark exudes a gum. The tree is not uncommon among the Lower Hills some distance west of the Jumna.

1942.—[134]. **Gleditschia triacanthos.**

Wood hard and dark. A fine thorny tree, introduced into the Punjab by the Agri-Horticultural Society.

1943.—[135]. **Gmelina arborea.**

Vern Syn.—Kúmhár.

The wood is light, of a pale yellow color, easily worked, and does not shrink or warp. It is very durable under water. It is used for picture frames, musical instruments, &c. The tree is not available in quantity west of the Sutlej, but is worthy of cultivation.

1944.—[136]. **Grewia Asiatica.**

Vern. Syn.—Fálsa.

Grows wild in the Kangra hills, and is cultivated in the plains. The fruit is edible, and much used to make sherbet as a cooling drink.

1945.—[137]. **Grewia betulæfolia.**

Vern. Syn.—Shikári mewa (Kúhat*).
Khírcha indzar (Pashtú).
Kanger (Salt Range).

A small shrub: common wild in Lower Hills, &c.

1946.—[138]. **Grewia elastica.**

Vern. Syn.—Dhamún.
Farrí, dháman, falwá (Salt Range).

* Stewart's "Notes on the Flora of Wazirístan."

A strong, tough and durable timber: very good for buggy shafts. Elevation, 4,000 feet.

1947.—[139]. **Grewia oppositifolia.**

Vern. Syn.—Behul. Dhámnú. | Pastawana (Pashtú). Dámán (Kaghán), (CLEGHORN).

The timber possesses similar properties with the last. It emits an offensive odor in burning; the bark is used as a fibre for ropes. The tree grows at an elevation of 5,000 feet. *G. elastica* is frequently confounded with this species.

1948.—[140]. **Grewia Rothii.**

Vern. Syn.—Battar, garges and níkí bekar (Salt Range). | *G. villosa*, jalidar, thamther, karkusrí. (Salt Range).

A small shrub: occasional in Lower Hills.

1949.—[141]. **Grislea tomentosa.**

Vern. Syn.—Dhau safaid.
Dháwí.

A specimen called "táwí" or "táaví," was sent from Murree Hills (8238). Common all over in low hills.

1950.—[142]. **Gymnosporia spinosa (Celastrus spinosus).**

Vern. Syn.—Jaliddhar.
Patákí, kander, phúphárí (Salt Range).

A specimen is included in the Shahpúr collection from the Salt Range (5316). It is made into walking sticks; and is common in most low hills.

1951.—[143]. **Gynaion vestitum (Cordia vestita).**

Vern. Syn.—Indak, karúk (Salt Range).

The wood is good and heavy, something like "kikar," but of small size; and in the Punjab is not much valued. It is used in making mill-wheels. The tree is not uncommon in the Lower Hills as far west as Rajauri.

1952.—[144]. **Helicteres isora.**

Vern. Syn.—Maror phallí.

Its seed vessel is curiously twisted or screwed up: also called "kupásí." It grows on the borders of the Jumna and in the Ambálah district. The seed is used in native medicine.

1953.—[145]. **Hippophae salicifolia.** Buckthorn.*

Vern. Syn.—Súrch (Sutlej valley). Tserdkar† (white-thorn in Thibetán; it is called in books starbú). | Súts (Kanáwar). Kálá bís (Kágbán).

The wood of this thorny shrub is much valued as a fuel in the barren province of Lahaul. It grows at 10,000 feet above the sea level. The fruit has been tried preserved with sugar, but is not so used by natives. It is mentioned in Thibetan books on medicine as useful if boiled into

* The people in Kaghán confuse the willow, the *Hippophäe*, and tamarisk (*Myricaria*), and call all "bís."
† Communicated by the REV. MR JAESCHKE, Moravian Missionary.

a syrup in diseases of the lungs, &c., &c. The branches are so much valued for dry hedges and for fuel, that they are considered as village property.

1954.—[146]. **Holarhena antidysenterica.**

Vern. Syn.—Kúra.
Kyúr (Kangra, &c.)

The timber is white and close-grained, and used by carvers. It is found in the Sutlej valley and in Kangra, but not further west.

1955.—[147]. **Hymenodictyon excelsa.**

Vern. Syn.—Barthoa (Hushyarpúr); thab?

Wood good: said to be used for scabbards and gun-stocks (?) The bark is intensely bitter, and possesses febrifugal properties.

Hyperanthera pterygosperma (See **Moringa**).

1956.—[148]. **Ilex dipyrena.** Wall.

Vern. Syn.—Kanelú (Chamba).

The wood is heavy, hard, and fine grained, much like common holly, and used for various purposes of carpentry.

1957.—[149]. **Indigofera arborea.**

Vern. Syn.—Káthí or kaintí.
Jand (Murree Hills).
Máthú (Chamba Hills).
Kástín (Kanáwar).
Dug-kentí (Kaghán), (CLEGHORN).
Káskaí (Pashtú).

A shrub of no value as a timber tree. Elevation, 7,000 feet.

1958.—[150]. **Jatropha curcas.** Purging nut.

Vern. Syn.—Páharí arind.

Grows along the base of the Hills.

1959.—[151]—**Juglans regia.** Walnut.

Vern. Syn.—Akrót.
Ká (Sutlej Valley and Kanáwar).
Dún (Kashmírí).
Waghz (Pashtú).
Than, thaní (Chenáb district and Lahaul).

Produces a handsome, dark wood, much valued for furniture and gun-stocks. It is abundant in some parts of the Hills, but is generally cultivated and so much valued for its fruit, that little of the timber is available. Its elevation is from 7,000 to 9,000 feet.

1960.—[152].—**Juniperus excelsa.** (**J. arborea**). Pencil cedar.

Vern. Syn.—Leuri or suri (Sutlej).
Charai, chalai (Kaghán).
Devidear.
Dhúp* (Kághán).
Chilí (Chilás.)
Shúr, shurghú, or lewar or mewar (Kanáwar).
Shakpa (Chenáb in Lahaul).
Shúr, lewar (on Chenáb, &c.)
Dhúprí, chandan (Kamaon, &c.)

An excellent, hard, light wood, used for house and bridge building in Lahaul. Its strong fragrant odor keeps off insects. Fifty logs were brought down the Chenab† in 1862, and

* Is called because the twigs are burnt as a fumigatory for delirium in fever.
† "On this river it grows," says DR. CLEGHORN, "in considerable numbers from Tilaknath to Kyelang."

readily bought at Sealkot for cabinet purposes. This is positively stated by DR. CLEGHORN: but I am otherwise told that the timber is useless for such purposes. "It is the principal tree in the upper part of the Sutlej valley and in Lahaul. It forms small forests, especially on the southern slopes of the hills, at an elevation of from 9 to 12,000 feet. The tree seldom attains 30 feet in height and 6 feet in girth, but THOMSON mentions one perhaps 40 feet high; and I measured one below the monastery at Kyelang 13 feet in girth."—CLEGHORN. In Kághán, I have seen the tree much larger, one 14 feet, and one near Lulusar, 19 feet in girth. In STEWART'S "Chenab Report," much larger sizes are mentioned, viz. 30 and 33½ feet; the trees were very stunted in height however, and had to contend with the heavy snow-falls. The bark is red, separating into laminæ like birch, and apparently a good material for brown paper. JACQUEMONT mentions, "that vessels are made of this wood for carrying milk and water in Kanáwar" (Voyages, II., 373).

1961.—[153].—**Juniperus communis.**

Vern. Syn.—Langshúr (Kanáwar at Purbni).
Pethra (Kághán).

1962.—[154]. **Juniperus squamosa.** The creeping juniper.

Vern. Syn.—Páma or talu.
Theli (Kanáwar).
Harang (Pangi).
Pethri (Kaghán).
Bethal, pethal (Chenáb, &c).

Used as fire-wood on the high passes. Grows at from 12,000 to 13,000 feet.

To distinguish *J. squamosa* from *J. communis*, remember that the plant with the long scales is *J. squamosa*, and that with short ones is *J. communis*.

1963.—[155]. **Kydia calycina.**

Vern. Syn.—Polá or pulá.

This tree grows rapidly in the outer valleys, but is not common west of the Sutlej. Its bark is used to clarify sugar (JAMESON).

1964.—[156]. **Lagerstrœmia parviflora.**

Vern. Syn.—Adhwári.

The timber is hard and tough, but the tree does not grow west of the Sutlej.

1965.—[157]. **Lawsonia inermis.**

Vern. Syn.—Mehndi.

A mere shrub, makes a good hedge; the leaves are used in dyeing. (See under "Dyes") p. 451.

1966.—[158]. **Lonicera quinquelocularis.**

Vern. Syn.—Pathli (Chamba Hills).
Phút (Kághán, Murree, &c.).
Jarlangai (Pashtú).

A large shrub, very abundant throughout the Himálaya.

1967.—[159]. **Lycium Europæum (or L. Edgeworthii).**

Vern. Syn.—Kangi.

In the jungles of the central plain districts of the Punjab.

1968.—[160]. **Mangifera Indica.** Mango.

Vern. Syn.—Amb.
A'm.

The wood is open, yet durable if not exposed to wet; it is liable to be worm-eaten. It is much used for packing chests, and Bareilly chairs are generally made of this wood.

1969.—[161]. **Marlea begonifolia.**

Vern. Syn.—Chitpatra (Kaghán). Síálú (on the Wardwan, Kashmír). | Padlú (Rávi). Budánár, memoká (Kangra).

The *M. affinis* of some writers; quite an Eastern Himálayan species, but occasionally known in Kaghán and Kashmír.

Melia azadiracht. (See **Azadirachta indica**).

This tree is not common in the Punjab, as it requires moisture. In Hindústán it grows to a large size and yields a good wood. The leaves are also valued (*see* Drugs).

1970.—[162]. **Melia sempervirens.**

Vern. Syn.—Bakain.
Drek.

Very common in the Punjab, where it supplies the place of the "ním." The wood is not bad.

1971.—[163]. **Michelia champaca.**

Vern. Syn.—Champa.

The wood is close-grained and handsomely marked, but the tree is very scarce, only known in the Punjab as a cultivated tree, and in the valleys of the Kangra district. (*See* Barnes' Settlement Report, p. 18).

1972.—[164]. **Mimosa rubicaulis.**

Vern. Syn.—Rál (Murree Hills, &c.)
Allá (Salt Range).

Always small, and of no value for its wood.

1973.—[165]. **Mimusops elengi.**

Vern. Syn.—Maulsirí.

Wood soft. Only cultivated in the Punjab; there are some fine specimens in the Amb garden.

1974.—[166]. **Mimusops kanki.**

Vern. Syn.—Khirni.

Also cultivated.

1975.—[167]. **Morus alba.**

Vern. Syn.—Tút.

1976.—[168]. **Morus lævigata.** Mulberry.

Vern. Syn.—Tút.

Grows both in the Hills and Plains.

1977.—[169]. **Morus sinensis.**

Vern. Syn.—Chín-ki-tút.

Imported from China, and yields the best food for silk-worms.

1978.—[170]. **Morus parvifolia.**

Vern. Syn.—Karan or tút, or tútrí (Ds. [illegible])

The wood of all old mulberry trees is hard and highly esteemed: it is used for furniture,

parts of boats, &c. Grows in the Hills at elevations varying from 4,000 to 7,000 feet. The leaves form a valuable fodder for cattle.

1979.—[171.]. **Morus serrata.**

Vern. Syn.—Kímú (Kangra).
Ansoá (Kanáwar).

A *Morus* like this is marked on the specimen "chamú ghar ká" (Kotgarh.)

1980.—[172.]. **Myrica sapida.** Box myrtle.

Vern. Syn.—Kaiphal.

The wood in grain is very like birch, but of a darker color. The tree is occasionally met with in the Hills from 4,000 to 6,000 feet, but the wood is not generally sold in the bazars. The ripe fruit is used for sherbets.

1981.—[173.]. **Myricaria sp——?** *(M. germanica)*

Vern. Syn.—Hombú (Kanáwar).
Bis (Kaghán).

1982.—[174]. **Nauclea cordifolia.**

Vern. Syn.—Haldí or kaddam.

The wood is rather soft and of a yellow color. It suffers from being put in water. It is used for making slates for scholars in native schools.

1983.—[175]. **Nauclea parvifolia.**

Vern. Syn.—Khaim or phaldu. | Kalam or karam (Punjabí).

The wood of this species is rather superior to *N. cordifolia.* It is used for planking, packing boxes, &c. Both species are found in Hushyarpúr and Kangra, and might be suitable for sleepers if impregnated with mineral salt.

1984.—[176]. **Nerium odorum.**

Vern. Syn.—Kaner.
Gandehra (Kálú, &c.)

A mere shrub; wood very poisonous.

1985.—[177]. **Nussiessya hypoleuca (Bœhmeria salicifolia).**

Vern. Syn.—Sihárú.

A shrub. A small specimen of the wood is in the collection. Elevation, 6,000 feet. (*See* "Fibres.")

1986.—[178]. **Nyctanthes arbortristis.**

Vern. Syn.—Karrí.
Harsinghár. | Kúrt (Kalesar, &c.)

Common in the Lower Hills as far west as the Rávi. It has rough scabrous leaves,* and the flowers yield a yellow dye for silk.

1987.—[179]. **Odina wodier.**

Vern. Syn.—Kemal or kyámal (Murree Hills).
Jingan (Simla Hills, &c.) | Díla (Shahpúr).
Kamlai, kambal (Salt Range).

* Cleghorn's "Notes of the Vegetation of Sutlej Valley," p. 12.

1988.—[180]. **Olea Europea,** (L.); **Ferruginea** (Royle); **Cuspidata** (Wall). Olive.

Vern. Syn.—Kahú, kau.	Wí (Sutlej Valley).
Khwan or khowan (Trans-Indus).	Wili (Kanáwar).
	Kán (Pangi, the Chenab, &c.)

The wood is strong, hard, heavy and compact, good for all mechanical purposes, but generally not obtainable of large size. In the Salt Range, however, specimens are not unfrequently met with having stems from 2 to 3 feet in diameter. It is used for the teeth of wheels in the Madhopúr workshops, for combs, tool handles, &c. It is found in the hills of the East Punjab, but is more common in the Salt Range, Hazára, and the valley of the Indus, from 3,000 to 5,000 feet, along with *Quercus ilex*.

Ougeinia dalbergioides. See *Dalbergia*.

1989.—[181]. **Paliurus aculeata.**
Vern. Syn.—Thúm (Kanáwar).

1990.—[182]. **Parkinsonia aculeata.**
Vern. Syn.—Wilaiti kikar.

The wood is only used for fuel, it makes good charcoal. It has been naturalized in the Punjab, and is planted for fences, for which it is well adapted.

Parrotia Jacquemontiana (see *Fothergilla involucrata*).

1991.—[183]. **Pavia indica.** Indian horse chestnut.

Vern. Syn.—Gúnh, gúah or júah (?)* (Kúlú).	Banúkhrot (wild walnut).
Tonjaga (Pashtú).	Banakhor, bankhor.
Pú (Kanáwar).	Gúgaí (Chenáb, Lahaul, &c.)
	Knór.

The wood is white and soft, sometimes used for furniture, and turns well in the lathe. The tree is abundant in Kúlú and other parts of the hills, from 6,000 to 8,000 and 9,000 feet. It is a beautiful tree, yielding a grateful shade; the seeds are eaten by the hill people in times of scarcity; but require long maceration in water first, as they are very acrid.

1992.—[184] **Pentaptera tomentosa (P. glabra.)**
Vern. Syn.—Sain or asun (arjan).

An excellent, hard and compact timber, well suited for building and railway purposes. It is found in Kangra in Sub-Himálayan forests, and is not uncommon as far west as the Rávi, but not of a large size. It is well suited for avenues and plantations in the east Punjab.

1993.—[185]. **Phœnix sylvestris.** Wild date.
Vern. Syn.—Khajúr.

Rafters are made from this in the Múltán division; also pillars and water troughs. It yields a rope fibre.

1994.—[186]. **Picea webbiana (Picea pindrow).** The silver fir—Webb's pine.

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* *See* Cleghorn's Western Himálayan Forest Report, p. 80.

Vern. Syn.—Toṅs (from Sutlej to Jhilam).
Pandur (Kotgarh).
Palúdar (Hazára).
Rewan (Kaghán).
Pé (Lahaul).
Dhúnú (Pangi).
Sal (near Badrawar).
Rrei (Chilás).
Ríyál, túng, birré (Kashmír).
Bajúr (Pashtú).
Pan, span or krok (Kanáwar).
Budil.
Pindrau, pandrai, chilrau, chilrai, khatrau thanera (Sutlej Valley and Basahir).
Moranda, rághá, raisalla (Kamaon, &c.)

It grows at an elevation of from 8,000 to 11,000 feet. The timber is not so much valued as that of the other pines—but is used for shingles in roofing, being cleft, not sawn, into pieces. To non-botanical eyes there is a kind of resemblance between this tree and *A. smithiana*, in their straight growth and ragged style of foliage; but on closer inspection the difference is great—the *A. smithiana* has a tassel-like pendulous style of branch, unlike the crisp, ragged boughs of Webb's pine: the leaves of Smith's pine are green, those of Webb's besides being much shorter, are dark green and white underneath.

1995.—[187]. **Pinus excelsa.** Lofty pine.

Vern. Syn.—Kail or kahl (Sutlej).
Dárchil (Chamba).
Partal (Kaghán, Jhilam, Chamba, &c).
Andal (Chenáb).
Lhím tser, chítí (Kanáwar, Chamba, &c.)
Bí,ár (Hazára).
Limanza (Pashtú).
Pínní (Kafir).
Shom shing (Lahaul).
Yári (Kashmír).*

It grows at an elevation of from 7,000 to 11,000 feet, and its name "excelsa" refers to the elevation at which it flourishes, not to its stature, which in general is nothing remarkable, though specimens occur of 120 feet in height. It does not, however, grow as high as deodar. THOMSON mentions seeing a stunted tree at 12,500 feet in the north-east side of the Runang Pass (Kanáwar). The wood is white, free from knots, and so resinous as to be used for flambeaux. It is the principal building material at Murree; as it retains its resin, it is stronger and superior to all the other pines, and is much esteemed for charcoal for smelting iron ore in Basahir.

1996.—[188].—**Pinus Gerardiana.** Gerard's Pine.

Vern. Syn.—Rí (Kanáwar).
Neoza or chilgoza.
Chirr (?)
Mirí and galgoja (Pangi).
Kashtí (Rávi).

This tree grows beyond the range of periodical rains far among the hills, at elevations from 5,000 to 10,500 feet, and is indicative of a dry climate. It does not attain a large size,† and the wood is not used. It does not occur in Kaghán. The nuts are much prized as an article of food, and sell about 2 annas per seer in the hills.

1997.—[189].—**Pinus longifolia.** Long-leaved pine.

Vern. Syn.—Chil or chír.
Nashtar or nakhtar (Pashtú).
Salla and sarl (Hindústání, and in the Himálaya beyond Punjab).

* MADDEN. Observations on Himálayan Coniferæ. J. A. H. S. Vol. IV., p. 221.

† DRS. BRANDIS and STEWART mention, that the largest specimen they saw in the Busahir forests had a girth of 9 feet. Report on the Deodar Forests of Busahir, sec. 25, p. 12.

It grows at elevations from 1,500 to 7,000 feet, never in thick dense forests: the trees require light for their growth. From the facility of obtaining this wood, and its lower price, little else is used in many places, and in the dry climate of the Punjab it is found to last better than in the N. W. Provinces or Bengal. There are two varieties known to traders—one with straight, the other with twisted, fibre; the former is much preferred, especially when required for planks. The bark is employed in the preparation of charcoal, and the resin for dressing sores. The tree is thus described by BARNES*:—

"Advancing into the interior, the cheel (*Pinus longifolia*) forms the usual decoration of the hills. It grows luxuriantly on the northern declivities, and is seldom or never found on the *southern aspect of a range*.† This pine appears to be very hardy and adapted to a great variety of climate. I have observed detached trees in the Joala Mookhee valley, at an elevation of only 1,600 feet above the sea, and the same species is found on the snowy range, as high as 7,000 feet. In hot and exposed situations, the growth is stunted, and the wood worth little or nothing. In sheltered localities, however, the forest consists almost entirely of erect well-shaped trees, some of which will yield beams 30 feet long, and planks upwards of 2 feet in width. The luxuriance and compactness of the timber increase with the elevation, up to 5,000 or 5,500 feet; and the climate of this region appears the best suited for its development; above and below this point, the tree gradually deteriorates."

1998.—[190].—**Pistacia integerrima.**

Vern. Syn.—Kakar or kakrain (Kangra). Sarawán (Pashtú). Kangar (Murree Hills). Kakrangche (Kanáwar). Khangar or kakkar (Salt Range, &c.)

A fine, close-grained timber, universally prized for ornamental furniture. Samples have been sent to the Exhibition from all the hill districts between Simla and Peshawur. The tree is often referred to as *Rhus acuminata*. It grows at 5,000 feet.

1999.—[191]. **Pistacia terebinthus.**

Vern. Syn.—Shne (Pashtú).

2000.—[192]. **Platanus orientalis.** Oriental plane.

Vern. Syn.—Chinár. Búná, bú,ín and boniù (Kashmír). Chintar (Pashtú).

The wood is rather soft, but beautifully marked, and is suited for doors, furniture, turnery, &c. The tree has been introduced from Kashmír, and is an excellent avenue tree. It is not, however, indigenous to the Kashmír valley. It never seeds there, and is always propagated by cuttings. All the trees found in Kashmír are in gardens or along roads, and have been planted. Sometimes its bark is attacked by a disease, or kind of hypertrophy, which produces a substance like cork. DR. JOHNSTON, of Gujrát, writes:—"While at a Punie, in the Neshát Bágh, in May last, I was struck with the appearance of an unnatural growth on the stem of the Eastern plane; it resembled cork in appearance, color, consistence, elasticity, cut with the same gritty creak, made good bungs; in fact was, to all intents and purposes, cork.

"I soon determined that it was no fungoid growth, and after careful investigation came to the conclusion that it was a homogenous hypertrophy of a cell constituent in the epiphlœum or outer layer of the bark. The mass removed by me weighed upwards of two seers; I regret its loss on the down march from Kashmír."

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* Settlement Report Kangra District, sec. 142.

† This is very questionable indeed.—B. P.

2001.—[193]. **Poinciana regia.**

Introduced, and grows well in the Badamí Bágh at Lahore. It is not useful for timber, but is valued for the excessive beauty of its feathery foliage, which is of the most vivid green, and contrasts strikingly, when the tree is in flower, with its gorgeous scarlet blossoms.

2002.—[194]. **Pongamia glabra.**

Vern. Syn.—Karanj (Urdu).
Rárá (Kangra).
Paphri or sukchain.

The wood is said to be light, but useful for common purposes. The tree is not uncommon in Hushyarpúr, but small. Oil is obtained from the seeds, and the leaves are sometimes used as manure.

2003.—[195]. **Populus alba.** White poplar, or Abile.

Vern. Syn.—Sofaida.
Spérdor or speldá (Trans-Indus).
Frás (Kashmír).
Mál (Kanáwar).
Channan and chanúní (Chenáb, &c.)

The wood of all the poplars is soft, white, easily worked, and suited for carving. *Populus alba* is cultivated Trans-Indus and in Kábul; the boxes in which the grapes are exported are made of it. The tree grows to a large size in Pangi, and is used for roofing in Ladákh and Lahaul.

2004.—[196]. **Populus balsamifera.**

Vern. Syn.—Yarpa (Lahaul) Cleghorn.

2005.—[197]. **Populus ciliata.**

Vern. Syn.—Pahári pípal.
Bagnú (Kaghán).
Krammal (Kánawar).
Phálja (Hazára and Murree).
Fálsh or palâch (Kashmír).
Chalún (Kotgarh).
Pábe and chanún (Chenáb).

Wood not valued. Grows at 6,000 feet above the sea level. The coma of the seeds is good for paper material, and is seen lying like snow on the ground in many places.

2006.—[198]. **Populus Euphratica.** Euphrates poplar.

Vern. Syn.—Labhán.
Bhán,
Bahán (Pashtú).

The timber is good, not very hard, white or yellow, suitable for turning. The tree grows on the banks of the Indus and Chenáb. The twigs are exported and sold at Lahore and elsewhere for tooth-brushes.

2007.—[199]. **Populus fastigiata.**

Vern. Syn.—Safeda (Kashmírí).
Do (Kanáwar).

In Kashmír it is called "frast." A sample was sent from Amritsar (5151). *Populus nigra* is almost the same thing: it is planted near villages. Lahaul (Cleghorn).

2008.—[200]. **Premna arborea?**

Vern. Syn.—Phakra.

2009.—[201]. **Prinsepia utilis.**

Vern. Syn.—Bhekar or bhekul. Bhekling (Kanáwar). | Garandu (Murree). Chamba (Kaghán, &c.)

Sample (5049), Simla collection. Elevation from 4,000 to 8,000 feet. Grown to form hedges (Cleghorn). Its seeds yield oil.

2010.—[202]. **Prosopis spicigera (Prosopis stephaniana).**

Vern. Syn.—Jhand. Kandi (in Dera Gházi Khán and Sind). | Aghzakár (Pashtú). Sé (Salt Range).

Yields the chief supply of fuel to the Punjab Railway, being a frequent tree in the rakhs.

2011.—[203]. **Prunus domestica.** Plum.

Vern. Syn.—Aru Bukhára. Alúcha.

Cultivated, wood not generally sound, but handsome, resembling pear or cherry. It is used in turning.—Not available in quantity (cultivated).

2012.—[204]. **Prunus insitita.**

The bullace plum of Europe: is indigenous in Kashmír.

2013.—[205]. **Prunus padus.**

Vern. Syn.—Jamún. Kálákát. Krán (Kanáwar). | Bart (Kaghán). Páras (Kaghán).

The bird cherry (*Cerasus cornuta*), 5438. Grows at Simla, and at an elevation of from 7,000 to 10,000 feet. I have seen the people in the Murree Hills eating the black berries of this tree. A species of *Prunus*, called "litsi," ripens its fruit in September in Lahaul; its fruit is described by Cleghorn as being sweet, and something like a cherry.

Prunus Armeniaca (*See Armeniaca*).

Prunus puddum (*See Cerasus*).

2014.—[206]. **Psidium pyriferum.** Guava.

The wood is small but very hard, and is used for handles of tools, mallets, &c. It is only cultivated in the Punjab.

2015.—[207]. **Pterospermum acerifolium.**

Wood hard and small, not available west of the Sutlej. Doubtfully wild.

2016.—[208]. **Punica granatum.** Pomegranate.

Vern. Syn—Dárú (wild). Dárim (Hills, Murree, &c.) | Darúní (Kaghán). Anár (cultivated).

Only brush-wood for fuel. In gardens sometimes forming inner fences.

2017.—[209]. **Putranjiva Roxburghii.**

Vern. Syn.—Putájan or jíapota.

A close-grained, useful wood, but small, and not plentiful.

2018.—[210]. **Pyrus aucuparia.**

Vern. Syn.—Battal (Kaghán).

The tree closely resembles, if it is not identical with, the mountain ash, or "rowan" of England and Scotland.

2019.—[211]. **Pyrus baccata.** Crab-apple.

Vern. Syn.—Ban mehal (Kúlú).
Choda (Hazára).

Wood hard and tough. Fruit eaten.

2020.—[212]. **Pyrus communis.** Pear tree.

Vern. Syn.—Naspáti. | Tangi.
Nák.

Wood good for carving; procurable 6 to 10 inches in diameter, but rare.

2021.—[213]. **Pyrus kumaonensis.**

Vern. Syn.—Dodar (Murree Hills, Kaghán, &c., CLEGHORN). | Chótta (Kaghán).
Maul (Chenáb).

2022.—[214]. **Pyrus malus.** Apple tree.

Vern. Syn.—Seb or pálu. | Mánra (Pashtú).
Chú,í (Pangi name). | Chúng or chúnt (Pangi and Chenáb).

Cultivated on account of its fruit. Wood pretty hard and close, good for cog-wheels and gun-stocks, but inferior to the pear tree. The Kanáwar apples are inferior in flavor to those of Kashmír. Quantities of apples and pears are grown at Basauli, and exported to the plains. There are wild apples, called "shé," on the Chenáb; also another species of *Pyrus*, called "liri," "liwar," or "baror."

2023.—[215]. **Pyrus variolosa.** Wild pear.

Vern. Syn.—Mehal or kaiuth. | Kenth or shegal (Kanáwar).
Sanjad. | Shogul (Chamba).
Batangi (Hazára and Murree Hills).

Wood brown, compact, used in Ladákh for boards of books and printing blocks. The fruit eaten, when over ripe and decaying, like the European medlar. The elevation is from 3,000 to 7,000 feet. There is a *Pyrus* in the Pangi collection, under the name of "kurgh."

2024.—[216]. **Quercus annulata.**

Vern. Syn.—Báni (Kotgarh).
Bankau (Hazára and other collections). | Baráno (Kaghán).

It is tough, close-grained, used for building purposes at Rawalpindi.

2025.—[217]. **Quercus dilatata.** (*Q. taxiflora* of some writers).

Vern. Syn.—Mohrú. | Kré,ú (Chamba Hills).
Barungí (Hazára). | Marghang (Kanáwar).
Bár (Murree Hills). | Chora (Kaghán).

The timber of all the oaks is good, hard, and so heavy that it will not float. *Quercus dilatata* appears to be the species most esteemed: it is very durable and tough, and at the same time elastic. In the Western Himálaya it is more rare than the other species, *Q. ilex* and *Q. incana*. Its elevation is from 6,000 to 9,000 feet. "It is seldom, however, seen," says CLEGHORN* "below 6,000 or above 7,500."† The leaves of the young tree are covered with

* Report on Forests of Western Himálaya, p. 198.

† I have seen it, though small and stunted, at fully 8,000, if not more, on Dhain Kund in the Chamba Hills.

prickles, which gradually disappear in the older ones. The tree grows to a huge size, many specimens may be seen 12 feet in girth, and from 80 to 100 feet high. All the Himálayan species are evergreen, and the leaves of *Quercus dilatata* specially afford valuable nourishment in winter to sheep and goats.

2026.—[218]. **Quercus ilex.**

Vern. Syn.—Balút.
Chúr (Kishngunga).
Chora (Kaghán).
Kori (Lower part of Kaghán valley).
Bre (Kanáwar).
Charí (Pashtú).
Khárpalú cherai.
Ghwara cherai.
Barungi (Murree Hills).
Irrí (Pangi, Chota Lahaul, &c.)

Cleghorn remarks that the name which belongs to *Q. dilatata* appears to be used for *Q. ilex* also. This species belongs to the Mediterranean flora, and the wood is hard, heavy and tough. It extends as far as Kanáwar, and finds there its extreme eastern limit. Mentioned by Drs. Brandis and Stewart as characteristic of Kanáwar. It is always a small rigid tree. The largest these officers met with was 6 feet 10 inches in girth, but had a clear stem 20 feet high. Elevation, 8,000 feet.

2027.—[219]. **Quercus incana.** Heavy oak.

Vern. Syn.—Bán.
Rín or rínj (Hazárá).
Vari (Salt Range).
Banji.
Sper cherai (white oak), (Pashtú).

The wood is coarse, but lasts well under cover, where it is not exposed. It is extensively used for fuel at the hill sanataria, where the tree grows abundantly. It grows from 3,500 to 8,000 feet.

2028.—[220]. **Quercus semacarpifolia.** Alpine oak.

Vern. Syn.—Kharsú, kharsúí (Kanáwar).
Banchar (Hazará).
Khatau (Pangi, &c.)
Kreú (Rávi).

The timber is much esteemed by natives, but as this species occurs near the upper limit of pine forests and is very heavy, it is seldom brought to market. Extensive forests exist on Hattú near Nagkanda. The tree is very tall and straight. Elevation, 9,000 to 11,000. "It seldom grows" says Cleghorn,* "below 8,000 feet, and ascends above the range of pines."

2029.—[221]. **Q. floribunda.**

Vern. Syn.—Barcha (Murree Hills).

Not common. Occasional at Murree: its timber is hard and much valued. Elevation, 9,000 feet.

2030.—[222]. **Randia (longispina?)**

This wood is (6165) in the Amritsar collection, called "rára."

2031.—[223]. **Randia dumetorum.**

Vern. Syn.—Míndhal.

Common in the Lower Hills as far west as the Rávi.

* Report of Forests in W. Himálaya, p. 79.

2032.—[224]. Reptonia buxifolia.

Vern. Syn.—Gurgura, garar (Salt Range).

The wood is small, but hard, fine-grained and useful. It is common in the Trans-Indus districts. Exclusively a Punjab wood.

2033.—[225]. Rhamnus virgatus (Persica ?)

Vern. Syn.—Wurak (Pashtú). Dadrú (Hazará and Murree). Phipni (Kaghán).

Wood is very hard and heavy, of a red-brown color. It is small and scarce, but useful for ornamental purposes in the Punjab.

2034.—[226]. Rhamnus purpureus.

Vern. Syn.—Rárí, nimarári (Chenáb). Kúnjí túndhé, &c., (Rávi). Chaterni (Sutlej). Tadrú (Jumna).

2035.—[227]. Rhododendron arboreum.

Vern. Syn.—Brás (Chamba Hills, &c.) Baraunás. Chachiyon (Kangra Hills). Ardáwal (Hazára and Murree).

The wood is coarse, brittle and brown in color, and little used except for fuel. It is not obtainable of large size. It may be had, however, for posts, &c., as large as 6 inches in diameter. The flowers are sub-acid, and are made into jelly. The tree grows from 6,700 feet to 8,000 feet.

2036.—[228]. Rhododendron campanulatum. Alpine rhododendron.

Vern. Syn.—Chamresh or simbar. Símrang (Kanáwar).

Grows at very high elevation, from 10,000 feet to 14,000 feet. The leaves of this species are very highly stimulant: they are used as snuff, under the name of Kashmírí patté. Wood small and crooked. An excellent fuel.

2037.—[229]. R. lepidotum.

Vern. Syn.—Tálsar.

Growing at a similar elevation, has the same properties (Cleghorn).*

2038.—[230]. Rhus acuminata.

Vern. Syn.—Húrkú (Kanáwar).

"Arkhar," is given by Stewart as the name of a *Rhus* in Kaghán; also in Pangi there is a *Rhus* called "arkhul" or "haláshí.

2039.—[231]. Rhus cotinus.

Vern. Syn.—Bághúna (Dera Ismaíl Khán). Túng (Kanáwar and Simla). Bán (Kaghán). Pan (Murree and Hazára). Largá (Shahpúr).

* Plants of the Sutlej Valley, p. 6.

Almost always small, but like the *Pistacia*, and some others of this family, is a zebra wood. Bark used for tanning.

2040.—[232]. **Rhus parviflora.**

Vern. Syn.—Túng.

Wood hard and yellow. It is small but excellent for turning. It grows at 5,000 feet.

2041.—[233]. **Rhus semialata (Rhus Buckiamela).**

Vern. Syn.—Hulúg. | Huláshing.
Titri. | Kashín (Kanáwar).

Not procurable in any quantity. Not so ornamental as other woods of this family. It grows like the others at 5,000 feet.

2042.—[234]. **Ricinus communis.** The castor oil plant.

Vern. Syn.—Arind, harind. | Harnaulí (Salts Range, &c.)
Bedanjír (Pers.)

There is a Sanscrit proverb, in the Hitopadesa, Book I., which says, "that where there are no trees, even the castor oil plant ranks as a forest tree." It grows, however, sufficiently large to produce specimens of wood, but is chiefly remarkable for the beauty of its large spreading leaves, and the value of its seeds, which yield castor oil.

2043.—[235] **Ribes nubicola, glacialis and grossularia.** Currant and gooseberry.

Grow at 11,000 and 10,000 feet, but the fruit is tasteless. CLEGHORN mentions a small, sour woolly gooseberry, called "bilítsi" in Lahaul. To these species belong the "gwal dákh," or gooseberry of Kaghán, and the "rásta," or currant of Lahaul.

2044.—[236]. **Roylea elegans.**

Vern. Syn.—Kaur (Chamba).

A shrub.

2045.—[237]. **Rosa Brunoniana.**

Vern. Syn.—Phulyárí guláb. | Phúlwárí (Kishngunga, &c.)
Guláb ghuri (Pashtú).

A small sized wood; makes walking sticks. In Murree they call it "chal;" but this they also apply to the jasmine.

2046.—[238]. **Rosa Webbiana.**

Vern. Syn.—Ringyál (Kanáwar).
Kantyán (Kaghán).

2047.—[239]. **Rosa eglanteria.** Yellow Persian rose.

Finds its eastern limit in Lahaul. CLEGHORN.

2048.—[240]. **Rosa macrophylla.**

Vern. Syn.——Phulyáù or phulwár (Kaghán).

2049.—[241]. **Rottlera tinctoria.**

Vern. Syn.—Kamela.
Kambha'.

Yields a soft wood, used for fuel. The stellate pubescence brushed off the fruit, is sold as a dye for silk at 18 rupees a maund; and as a drug, being powerfully vermifuge.

2050.—[242]. **Rubus fruticosa and R. flavus.** Yellow raspberry.

Vern. Syn.—Unsri (Sutlej valley).

Fruit used to make a preserve in the Hills: grows at an elevation of 5,000 to 7,000 feet.

2051.—[243]. **Rubus purpureus.** Himalayan raspberry.

Vern. Syn.—Akhi (Kúlú).

2052.—[244]. **Rubus lasiocarpus.**

Vern. Syn.—Pakána (Kaghán).

2053.—[245]. **Robinia macrophylla.**

Vern. Syn.—Ganj (Kalesar Forest, &c.)

A huge climber, common a little to the west of the Jumna.

2054.—[246].. **Sageretia oppositifolia.**

Vern. Syn.—Girtin.
Múmánraí (Pashtú).

Very common, but only useful as a fire-wood. The fruit (múmáni) is well known in the Peshawur bazar.

2055.—[247]. **Sageretia Brandrethiana.**

Vern. Syn.—Gangér.
Kunjar.
Kohér (Salt Range).

From the Dera Ismaîl Khan district.

2056.—[248]. **Salix Babylonica.** Weeping willow.

Vern. Syn.—Majnún.
Willa and khár willa, "big willow" (Pashtú).

Wood soft, smooth and white. The large wood is used for cricket bats, the small twigs for kiltas, baskets and rope bridges. Both this and *S. tetrasperma* are abundant at Peshawur and in the Hazára district.

2057.—[249]. **Salix alba.** White willow.

Vern. Syn.—Chung.
Madánú or shan (Kanáwar and Pangi).
Búshan (Upper Chenab).

The wood is most useful in Thibet and Spiti, and employed for boarding. The small twigs are used for basket work, and the leaves are highly valued in winter for food for sheep.

2058.—[250]. **Salix caprea (Ægyptiaca).**

Vern Syn.—Bedmushk (passim).
Khwagawalá (Pashtú).

Of very small size. Cultivated at Lahore.

2059.—[251]. **Salix tetrasperma.**

Vern. Syn.—Laili.
Bhúmtas.

2060.—[252]. **Salix sp.**——?

Vern. Syn.—Baddha (Pangi).
Bes, bais (Hazára).
Shan (Kanáwar).

2061.—[253]. **Salvadora oleoides.**

Vern. Syn—Jhál. Pílú. | Váñr (Punjabí). Plewan (Pashtú).

Wood close-grained, much used for fuel. Very common in the Múltán division. Toothpicks are made from the roots of a species of *Salvadora*.

2062.—[254]. **Salvadora Persica.**

The wood is rather strong and compact. The leaves are eaten as a salad. It is believed by some to be the mustard tree of Scripture.

2063.—[255]. **Sapindus acuminatus.** Soap-nut.

Vern. Syn.—Dodhan or ritha.

The wood is heavy and useful, but not available, as the berries are much valued and sold in every bazar as a substitute for soap. It is planted as an avenue tree in Kangra valley, and in Chamba, where it is common.

2064.—[256]. **Schleichera trijuga.**

Vern. Syn.—Kússúmb.

An excellent, hard, heavy wood, used in making sugar-mills, pestles, &c. Only procurable on the eastern verge of the Punjab, but worthy of cultivation.

2065.—[257]. **Semecarpus anacardium.** Marking-nut tree.

Vern. Syn.—Bilawa.
Bhiládar.

The timber is of little value. The acrid juice of the fruit is used as a medicine, and as a dye.

2066.—[258]. **Sesbania Ægyptiaca.**

Vern. Syn.—Jaint.

A very rapid growing shrub, suitable for hedges. Wood of no value.

Shorea robusta (*See* **Vatica**).

2067.—[259]. **Spirœa Lindleyana, S. hypoleuca, S. callosa, &c.**

Vern. Syn—Kikri and karkui (Kaghán).
Sarbashtai (Pashtú).

A hill shrub, with beautiful white flowers: resembles the English meadow-sweet, especially the species *S. Kamschadlica.* Wood of no value.

2068.—[260]. **Sponia Wightii.**

Vern. Syn.—Kanghi.

Occasional to the west of the Jumna.

2069.—[261]. **Spondias mangifera.**

Vern. Syn.—Ambára (Amritsar).

2070.—[262]. **Staphylea emodi.**

Vern. Syn.—Nagdáoñ. Már chob (Persian and Pashtú), "snake stick." | Kághaniya (Kanáwar). Chitra (Murree and Hazára.

Used for making sticks by the hill-people, who consider it a charm against snakes, hence its name of "nág-dáwan or dáman," snake subduer.

2071.—[263]. **Stillingia sebifera.** Tallow-tree of China.

Hard and durable wood, fitted for printing blocks, according to DR. JAMESON, who contributed the only specimen exhibited. This tree has now been successfully acclimatized, and its extended cultivation would be extremely advantageous from the quantity of tallow and oil extracted from the seeds.

2072.—[264]. **Symplocos paniculata.**

Vern. Syn.—Lodh.
Lodhar.

The wood is moderately hard, and used for posts. The bark is collected for sale as a dye.

2073.—[265]. **Syringa emodi.**

Vern. Syn—Sháfur or rangchúl (Kanáwar).

Up to 10,000 feet.

2074.—[266]. **Symplocos racemosa.**

Very like *Symplocos paniculata.*

2075.—[267]. **Sizygium jambolanum.**

Vern. Syn.—Jáman. | Sumra; the wild tree (Hushyarpúr).
Rúkhan. | Katammal (Kangra).

The wood is not considered durable, but is used for posts and beams. A good shady avenue tree.

2076.—[268]. **Sterculia Roxburghii.**

Vern. Syn.—Gód-gadála.

Common to the west of the Jumna, and occasionally as far as Rajauri. A fibre is made from its bark.

2077.—[269]. **Sterculia villosa.**

Vern. Syn.—Gul-bodla (Hazára). | Massú (Salt Range).
Gul-kundal (Jammú).

2078.—[270]. **Tamarindus Indica.**

Vern. Syn.—Imli.

This valuable tree yields a hard, dark colored, durable and finely veined wood. Not indigenous in the Punjab—a few specimens exist in gardens.

2079.—[271]. **Tamarix dioica.**

Vern. Syn.—Lai.
Kachlaí (Leia).

2080.—[272]. **Tamarix Gallica.** (Syn.—*Indica*).

Vern. Syn.—Pilchi, koá, rúkh, | Jhau.
laínyá (Salt Range).

Baskets made of the twigs.

2081.—[273]. **Tamarix orientalis.** Tamarisk.

Vern. Syn.—Farás. | Parwáñ.
Ukhán. | Khwa or ghwa (Pashtú).
Ujhán. | Ghaz (Persian).
Farwá. | Rúkh (Salt Range).

Wood of little value, emits an offensive odor when burnt. It is used for charcoal. It grows with rapidity, and is common in the saline tracts of the Punjab. Is known from *T. indica* by the bluish tinge of the leaf.

2082.—[274]. **Taxus baccata.** Common yew.

Vern. Syn.—Birmi (Hazára), where it is also called tung and tunní, badhar and sarrap (Pashtú). | Rakhál (Chamba and Béas). Sangal, postal (Kashmír). Yamdal (Kanáwar).

The timber is good, heavy and very durable, and takes a good polish. It is used for bows, buggy shafts and jampan poles. It is common near Murree, and in the valleys of the Sutlej and Béas. At an elevation of from 9,000 feet and also to 10,500. It alters its appearance and form of growth very much when it grows in the higher latitudes,* and when growing in deep forests. It is a large tree with naked trunk. It is often of great thickness, but seldom attains any great height; the thick trunk generally dwindles away or divides into branches at a few feet above the ground. On the skirts of the forests it is a lax almost prostrate bush, while on open slopes, it becomes a stout, dense and tabular branched tree.

2083.—[275]. **Tecoma undulata.**

Vern. Syn.—Rohira. Lahúrá. | Regdáwan (Pashtú).

Wood good but small, used for making charpais, spinning wheels and ploughs, in the Salt Range. The tree has beautiful orange colored flowers. This species has *large* lanceolate leaves; there is another *Tecoma*, which is called "lahúrí" in the Salt Range, and which grows side by side with it. This is distinguished by having very *small* lanceolate leaves. There is some doubt, however, as to whether these are in reality distinct species. Specimens of the latter may be seen in the Bádámi Bágh at Lahore.

2084.—[276]. **Tectona grandis.** Teak.

Vern. Syn.—Sagwán.

This fine tree has been introduced in various stations of the Punjab, but is liable to injury from frost. The qualities of its invaluable timber are well known. Its culture might be attempted wherever there is little frost.

2085.—[277]. **Terminalia belerica.**

Vern. Syn.—Bírha. Bahera. | Balela.

Wood white and soft, but not available, the fruit being eaten by the natives, and used as a medicine. It is a good avenue tree.

2086.—[278]. **Terminalia chebula.**

Vern. Syn.—Har. Halela.

Wood is hard and close-grained, but the fruit is highly valued, being used in tanning, dyeing and making ink. It grows at Holta, &c.

2087.—[279]. **Terminalia Arjuna.**

Vern. Syn.—Arjan.

* See SMITH and HOOKER'S Introduction to the Flora Indica. The whole passage about the variation of species is well worth attention, p. 30-33.

CLEGHORN gives *T. glabra* as "arjan," and says, the timber is used for railway sleepers.*

2088.—[280]. **Tetranthera Roxburghii.**

Vern. Syn.—Maidá.
Chándná.

No. 5155, &c., &c. The bark is called "maidasak" in native pharmacopœia.

2089.—[281]. **Trophis aspera.**

Vern. Syn.—Dahya.

The wood is good, but small and crooked. The scabrous leaves are used for polishing ivory.

2090.—[282]. **Ulmus campestris.** Elm (large leaved elm).

Vern. Syn.—Marál, marálí, mehan† (Kúlú). Marar (Murree Hills).
Mannú and Ká,íu (Hazára).

The wood is porous, but durable when constantly wet. It is, therefore, used for damp foundations. Grows to a large size in Kúlú and Chamba, and its range extends to the Mediterranean. "In the upper part of Kúlú," says DR. CLEGHORN, "there are many fine trees 30 feet in girth."

2091.—[283]. **Ulmus erosa.** Small leaved elm.

Vern. Syn.—Shko (Kanáwar).
Himbrah.

Grows at an elevation of from 6,000 to 9,000 feet. The wood is more open-grained than English elm, and is less esteemed than the last named.‡ I have seen a specimen at Berangalli in Hazara, 17½ feet in girth and over 100 feet high.

2092.—[284]. **Ulmus virgata.**

Vern. Syn.—Máldúng (Kanáwar).

At 9,000 feet (CLEGHORN).

2093.—[285]. **Ulmus integrifolia.**

Vern. Syn.—Kánjú.
Kachám (in the east of the Province).

The wood is strong, light colored, and adapted for general purposes.

2094.—[286]. **Vatica robusta.**

Vern. Syn.—Sál or sakhú (CLEGHORN).

This is the staple timber of Hindústán for building purposes. Its western limit is the Kangra Valley, where it is found of small size.§ The growth of this tree on canal banks is under trial, but the seeds will not germinate if kept many days; it is difficult to extend the plantations.

* CLEGHORN. Report Forests of the W. Himalaya, p. 79. † *Ibid*, p. 81. ‡ *Ibid* p. 12.

§ There is a small clump of these trees on the eastern part of the Kangra valley, near Sujanpúr tira. A few also occur near Rajpura in Hushyarpúr, which is the western limit of its growth (CLEGHORN'S Report on Western Himalaya Forests, note to p. 81). The wood of these trees, as well as their size and growth, bear no comparison to the magnificent trees of Hindústán and Bengal.

2095.—[287.]. Viburnum fœtens, V. continifolium, V. stellionatum.

Vern. Syn.—Banna.
Aklu (Kaghán).
V. cotinifolium is marghwalwa (Pashtú).
Kalkut (Khagán).
Rich and Thálín (Kotgarh).
Aklu (STEWART).
Gúch or kúch (Kaghán).*
Ban kúch (*V. cotinifolium*).
Jalbágú *(V. stellionatum)* Kaghán.

Forming the underwood of forests in the Himálayan valleys. The wood is used chiefly for fire-wood. The berries of both *V. fœtens* and *V. cotinifolium* are edible.

2096.—[288]. Vitex negundo.

Vern. Syn.—Sembhálú (Hindustání).
Banna (Plains).
Bankahú (Hazára, &c.)
Marwandé (Pashtú in DR. STEWART'S Wazíristán).
Marwa, mawá (Salt Range).

Banná is the hill name for *Viburnum*.

2097.—[289]. Vitis vinifera.

Vern. Syn.—Angúr.
Lanang (Kanáwar).

Grows in the hills also, at elevations from 7,000 to 9,000 feet.

2098 —[290]. Wrightea mollissima.

Vern. Syn.—Dúdhi.
Kiláwa (Kangra).

The timber is soft and light, and much used in ornamental carving. Samples were exhibited from Sahárаupúr. This tree is very rare in the east of the Province.

2099.—[291]. Wrightea tinctoria.

The wood is white, close-grained, and used for turning.

2100.—[292]. Xanthoxylum hostile.

Vern. Syn.—Tezbal.
Timmal.
Timrú (Kanáwar).

Small timber, used for walking sticks and for pestles. It is strongly armed with prickles, hence the name "hostile." The aromatic fruit is used as a condiment.

2101.—[293]. Zizyphus jujuba.

Vern. Syn.—Ber.
Berrá (Pashtú).

Wood hard and durable, and when of a sufficient size, may be applied to many useful purposes. It is made into combs, charpais, clogs, and saddle trees; all these purposes indicate toughness.

2102.—[294]. Zizyphus vulgaris. Common jujube.

Vern. Syn.—Pitní or fitní (Kághán).
Ber.
Amni, amlaí, amrá, ímlá (Salt Range).

In many respects like the last. Both species are cultivated.

* This name is also given to *Coriaria nepalensis*.

2103.—[295]. **Zizyphus nummularia.**

Vern. Syn.—Malla. | Karkaṅrá (Pashtú).
Jar-berí(Hindustání). | Bírota (Salt Range).

Used for hedges, and the bark as a tanning substance.

2104.—[296]. **Zizyphus flexuosa.**

Vern. Syn.—Sinjlí (Kaghán).

REPORT ON TIMBER AND ORNAMENTAL WOODS.

CLASS IV. SUB-CLASS (F).

THE JURY WAS COMPOSED OF THE FOLLOWING GENTLEMEN:—

MR. TER ARRATOON,
LIEUT. J. CHALMERS, *Deputy Conservator of Forests, Rávi and Chenáb.*
DR. CLEGHORN, *Conservator of Forests,*
CAPTAIN DYAS,
MR. JOSEPH HARRISON, *Chief Engineer, Punjab Railways.*
CAPTAIN ARTHUR LANG,
KUNYHA LALL, *Executive Engineer,*
MR. MAY, *Punjab Railway, Supdt. Workshops,*
MELA RAM, *Contractor,*
DR. J. L. STEWART, *Conservator of Forests.*
COLONEL SIM, *Consulting Engineer,*
MR. WATSON, *Supdt. Workshops, Baree Doab Canal.*

REPORTER.—DR. CLEGHORN.

THE importance of this section of the Exhibition can scarcely be over-estimated in the comparatively woodless province of the Punjab, where the value of timber has always been great and is rapidly increasing. To illustrate the rise in price of this necessary commodity in eight years, the subjoined statement, obtained from the Fírozpúr Arsenal is given:—

Name of wood.	Per cubic foot, running foot or number.	Rates prevailing in																				
		1857-58			1858-59			1859-60			1860-61			1861-62			1862-63			1863-64		
Deodar,	Per c. ft.,	0	12	0	0	12	0	0	12	0	0	12	0	0	12	0	0	0	0	0	12	0
Sál, 2nd size,	Do.,	1	8	0	1	13	0	1	13	0	1	13	0	1	13	0	1	13	0	1	13	0
Babúl,	Do.,	0	8	0	0	12	0	1	0	0	1	0	0	1	0	0	1	0	0	0	0	0
Bamboos, 1st size,	Each,	1	0	0	1	0	0	1	0	0	4	0	0	4	0	0	4	0	0	4	0	0
Do., 2nd size,	Do.,	0	3	0	0	2	6	0	3	6	0	3	6	0	4	0	0	4	0	0	4	0
Do., small,	Do.,	0	1	0	0	1	0	0	1	0	0	1	6	0	1	6	0	3	0	0	3	0
Sál,	Per r. ft.,	0	0	0	0	0	0	0	7	0	0	7	0	0	7	0	0	7	0	0	7	0
Deal,	Do.,	0	1	10	0	1	10	0	2	0	0	3	0	0	4	0	0	4	0	0	4	0

With the object of obtaining as valuable a series of indigenous woods as possible, the following instructions were published by the Exhibition Committee.

Information required.—Exhibitors should furnish the *local* name and the dimensions which the trees attain in particular districts, measuring the girth *four* feet from the ground. The uses to which the several parts of the tree are applied should be mentioned.

Size, &c., of specimens.—A horizontal section of the tree with bark complete, and about 3 inches thick, shows the character of the entire timber. Bars 2½ feet long and 2 inches square, cut from the sound wood, enables trials to be made of its strength.

Nomenclature.—When there is any doubt as to the tree, a small shoot bearing flowers, fruit, and full grown leaves should be pressed flat in a sheet of paper and marked with a corresponding number. Paper labels are unsafe, the specimens should have a number painted or cut into them.

The result is highly gratifying, as specimens of so many different North Indian woods have not been brought together since the well known collection of Dr. Wallich, made during his Botanical Mission to Nepál, subsequently deposited with the Society of Arts, London.

Twenty districts have contributed collections. Four native princes (the Maharajah of Kashmir, and the Rajahs of Kapurthalla, Pattiala and Chamba), and four private exhibitors (Dr. Brandis, Dr. Jameson, Dr. Cleghorn and Mr. Stephen Berkeley), have also contributed. The specimens sent are very numerous, covering four tables, and include all the important timbers of the province, with some very curious applications.

The largest and most instructive collection is that of Dr. Brandis, illustrating the forest resources of Burmah, by 112 samples, accompanied by a printed catalogue; there is also a series of specimens from the Central and North Western Provinces. For a duplicate set of the former series, Dr. Brandis received a medal in the London Exhibition of 1862. The specimens are all cut to size, well seasoned and the specific gravity carefully ascertained; in this respect they are most valuable.

The next collection which the Jury have to notice is that of Dr. Jameson. Consisting of 40 specimens grown in the Saharunpúr Garden, under his direction, a list of these is given below. The block of *Stillingia sebifera*, an introduced tree, is particularly interesting.

Acacia Arabica,
——— *elata,*
——— *modesta,*
——— *speciosa,*
Artocarpus integrifolia,
Bignonia suberosa,
Cassia fistula,
Casuarina muricata,
Cedrela toona,
Cordia myxa,
——— *lanceolata,*
Dalbergia sisso,
——— *robusta,*
Ehretia aspera,
Ficus elastica,
—— *Indica,*
—— *religiosa,*
Gmelina arborea,
Hibiscus tricuspis,
Mangifera Indica,
Melia azadirachta,
—— *sempervirens,*
Mimusops kauki,
Morus Indica,
Nauclea parvifolia,
Pinus longifolia,
Pongamia glabra,
Psidium pyriferum,
Pterospermum acerifolium,
Pyrus communis,
Salix Babylonica,
Shorea robusta,
Solanum giganteum,
Stillingia sebifera,
Syzygium jambolanum,
Tectona grandis,
Tetranthera monopetala,
Trophis aspera,
Wrightia mollissima,
Zizyphus vulgaris.

Though the Jury are precluded from offering rewards for specimens not the growth

of the Punjab, they have, as a special case, awarded medals and certificates to DRS. BRANDIS and JAMESON; their collections are rich in new or little known timbers, and as some of them are found within the limits of the Province, the information elicited is of practical value.

The 3rd collection, in point of interest, is one showing the woods procurable in the Simla bazar, consisting of specimens in the form of bricks. Though not thoroughly seasoned, the specific gravity of many has been approximately ascertained. As information is defective regarding the woods of the Western Himálayas, and as accurate lists of the woods in local use at the different sanataria is a great *desideratum*, the Simla list is given below:—

Number.	English.	Vernacular.	Botanical.	Weight of cub. ft. in pounds.
1	Deodar, ..	Kelu, ..	*Cedrus deodara,* ..	37
2	Lofty pine, ..	Kail, ..	*Pinus excelsa,* ..	25
3	Common oak, ..	Bán, ..	*Quercus incana,* ..	55
4		Mohru, ..	——— *dilatata,* ..	68
5	Toon tree, ..	Tuna, ..	*Cedrela toona,* ..	37
6	Box, ..	Shamshád, ..	*Buxus sempervirens,* ..	69
7	Mulberry, ..	Kimú, ..	*Morus serrata,* ..	40
8		Kakar, ..	*Rhus integerrima,* ..	63
9	Toong, ..	Túng, ..	——— *parviflora,* ..	
10	Wild pear, ..	Kainth, ..	*Pyrus variolosa,* ..	52
11	Cherry, ..	Paddam, ..	*Cerasus puddum,* ..	64
12	Apricot, ..	Jaldáru, ..	*Armeniaca vulgaris,* ..	64
13	Walnut, ..	Akhrot, ..	*Juglans regia,* ..	33
14	Maple, ..	Karandlu, ..	*Acer oblongum,* ..	
15		Ayar or eliyun, ..	*Andromeda ovalifolia,* ..	35
16	Rhododendron, ..	Brás, ..	*Rhododendron arboreum,* ..	37
17		Kaiphul, ..	*Myrica sapida,* ..	54
18	Moutain ebony, ..	Kachnár, ..	*Bauhinia variegata,* ..	
19	Nettle tree, ..	Karrak, ..	*Celtis Caucasica,* ..	47
20		Tezbal, ..	*Xanthoxylon hostila,* ..	52
21	Berberry, ..	Rasaut, ..	*Berberis sp* —. ..	67
22		Chubi, ..	*Acacia speciosa,* ..	27
23	Soap-nut tree, ..	Ritha, ..	*Sapindus emarginatus,* ..	73
24	Hill bamboo, ..	Nirgali, ..	*Arundinaria utilis,* ..	
24		Rauns, ..	*Cotoneaster bacillaris,* ..	
25	White thorn, ..	Gengáru, ..	*Crataegus crenulatus,* ..	
		Nagdáun, ..	*Staphylea emodi,* ..	

MR. S. BERKELEY's collection contains 36 well varnished specimens, with native names, most of which have been indentified. The specimens are very small, only about 2 inches square, and many of them are sapwood, but the collection deserves honorable mention, because it illustrates the wood resources of the Sutlej Valley near Kotgarh.

Regarding the local collections, which are instructive as showing the resources of each district, and sometimes contributing interesting facts connected with the Geographical distribution of species, it seems unnecessary to describe them *seriatim*, but the subjoined table showing the number of specimens from each district, aggregating about 1,000, will give an idea of the labors of the Jury.

Delhi, ...	13	Jálandhar (a large collection).	
Rohtak, ...	20	Kangra, ...	1
Sirsa, ...	1	Hushyarpúr, ...	10
Simla, ...	28	Amritsar, ...	38
Kotgarh, ...	36	Lahore, ...	3

Rawalpindi,	80	Peshâwur,	132
Gújrát,	27	Hazára,	29
Shahpúr,	14		
Gugaira,	17		
Muzaffargarh.		*From Native Chiefs.*	
Dera Ismaîl Khan,	54	Chamba,	46
Dera Ghází Khán,	19	Pattiala,	18
Bunnoo,	1	Kapúrthalla,	2

The Jury would submit that a complete series of the woods exhibited would be most useful to Government, and should be deposited in the Lahore Museum for future reference.*

Hazára.—The collection from Hazára is worthy of special notice; the size of the specimens, and the care with which the vernacular and botanical names have been attached, deserve high commendation.

The collection from Chamba is very instructive. It is believed that this is the first time that a series of the useful woods from the upper Chenáb has been exhibited. The specimens were all ticketed in the forest by Mr. J. A. Murray.

Shahpúr.—The collection from Shahpúr demands special commendation. Some of the specimens have been turned into cylinders of an ornamental character, showing well the texture of the wood. Cups carved from sissú wood are also exhibited.

Gújrat.—The contribution from the Gújrat illustrates well the building materials of the district. It consists partly of square blocks of sound heart-wood, showing the working qualities of the timber.

Dera Ismaîl Khán.—The collection from Dera Ismaîl Khán consists of 54 specimens. The local names have been given with care, a comparison of these with the Pashtú names of the adjoining districts, has enabled the Jury to identify some interesting specimens of little known woods from the Trans-Indus territory. The wood of "jallidhar" (*Celastrus spinosa*) not previously known to the Jury, has been sent from Dera Ismaîl Khán and Shahpúr.

Jálandhar.—The Jury have before them a large series from Hushyarpúr, Kangra and Kúlú. The specimens are cut to size, and well varnished, but the vernacular names have in some cases apparently been confused. The tract of country which the division embraces is known to be rich in woods, and our knowledge of the forests has been extended by recent inquiries.

Wood Engraving.—In connection with the proposed establishment of a School of Industrial Art in the Punjab, the Jury have directed their attention to the woods most suitable for the turner and wood-engraver. The varieties which appear best are as follows:—

Buxus sempervirens, Himalayan box.	*Bignonia suaveolens*,
Olea Europea, European olive.	*Capparis aphylla*, leafless caper.
Dodonæa Burmanniana,	*Citrus aurantium*, orange tree.

These are given in the order of supposed excellence. The box is superior to the others, and has been tried with success by the graver in Roorkee, Madras and Calcutta; several new habitats have lately been discovered in the Punjab, and it is found in the Sutlej Valley, Kúlú, Bara Banghal, near Rihlu, and on the Salt Range. Some facts regarding its distribution and properties were read before the Agri-Horticultural Society in July, 1863.

* A very large collection of nearly 300 Punjab species is now in the Museum, in double series; one arranged by Natural orders, the other Alphabetically, for easy reference.—B. P.

The Jury think it right to mention here two tables of ornamental workmanship, the first was made by KIRPA SING, carpenter, under the directions of MR. GORDON, C.E., Amritsar, and is composed of different kinds of wood. This has received a reward under the section "Carved Furniture." The second table is exhibited by CAPT. GARRET, R.A., and is formed of 1863 pieces of different kinds of Punjab woods.

In examining the different collections, the Jury availed themselves of the practical experience and technical knowledge of MR. MAY and MR. WATSON, of the Railway and Baree Doab Canal, Workshops.

JURY AWARDS.

Medals.

1.	DR. BRANDIS, ...	For collection of woods.
2.	DR. JAMESON, ...	Ditto.
3.	LOCAL COMMITTEE, Hazára, ...	Ditto, Hazára.

Honorable Mention.

4.	MR. J. A. MURRAY, Chamba, ...	Ditto, Chamba.
5.	CAPT. ED. PASKE, Gújrat, ...	Ditto, Gújrat.
6.	MR. S. BERKELEY, Kotghar, ...	Ditto, Kotghar.
7.	LOCAL COMMITTEE, Dera Ismaíl Khán,	Ditto, Dera Ismaíl Khán.
8.	CAPT. DAVIES, Deputy Commissioner, and DR. HENDERSON, Shahpúr, ...	Ditto, Shahpúr.

H. CLEGHORN,

Reporter.

SUB-CLASS (G.) CHARCOALS.

In the absence of coal, all ore smelting and other processes are dependent on charcoal, as well as the goldsmiths, and various other ornamental and useful trades.

Several species of charcoal are produced according to the requirements of the users. The manufacture of gunpowder requires charcoal of particular kinds, generally yielded by woods of a hard close grain.

The charcoal of the "madár" root is esteemed by goldsmiths in the Punjab, and the stunted growths of *karil, jánd* and *salvadora* in the district jungles, furnish sources of charcoal for other purposes.

The manufacture of "chíl" charcoal is extensively carried on where the border forests of "chíl" abound in Hushyarpúr and Kangra.

In the Hills the iron smelters employ almost exclusively the "chíl" charcoal, rejecting that made with the oak.

The manufacture of charcoal as practised by the native burners in the Hills is excessively rude and wasteful of material.

"There is great waste of valuable timber," writes Dr. Cleghorn, "in the manufacture of charcoal. With a view to remedy this evil, I held meetings of the charcoal burners at Simla and Dhurmsala, and showed them how to form a kiln and make charcoal more economically and of a better description than they had been accustomed to. The Chief Engineer proposes to issue a circular on this important matter, as only by repeated examples will the improved method, by which one-third less wood is required, be brought into general use. The charcoal burning must also be conducted out of the jungle to avoid the risk of fire to the surrounding forests."*

An excellent account of charcoal making, on good principles, and illustrated so as to explain the subject thoroughly, will be found at the end of Dr. Cleghorn's Forest Report, 1864, and also in the same author's "Forests of Southern India."

The specimens of charcoal were as follows:—

2105.—[5124]. Oak charcoal. Hills near Simla. Mr. Geo. Jephson.

2106.—[5125]. Oak charcoal. Second kind of oak (*Quercus incana* and *Quercus dilatata*). Simla.

2107. [5126]. Charcoal from chíl (fir). Simla.

2108.—[5136]. Charcoal of the chíl. Local Committee, Hushyarpúr.

Chíl is used for two purposes, for timber or for charcoal; it is but little cut for timber for export to other districts, on account of the cost of carriage. The traders who prepare charcoal in the Hushyarpúr district obtained wood from the Lohara, Panjal and Vairí forests: it can be as well supplied from the Siba and Jasrota forests of the Kangra district, but the traders do not burn in Kangra, as they say the cost of taking the charcoal from the Hills down to the Plains is too great; notwithstanding the fact that the price of a chíl tree in Kangra is from 1 to 6 rupees, while in the Hushyarpúr district, the rate is

* Dr. Cleghorn to Financial Commissioner, November, 1863.

uniform at 5 rupees per tree. The traders carry their charcoal to Amritsar, at which place, besides their ordinary trade, they supply the Railway Company. The company contracts at the rate of Rs. 131-4-0 per hundred maunds pucka of charcoal.

"I have ascertained," writes MR. BIRNIE BROWNE, "that the actual cost in the forests, after paying for the trees, &c., is Rs. 25, and the carriage from the forests to the road and from thence by camels to Amritsar is about Rs. 55, making a total of Rs. 80 per hundred maunds.

"The traders therefore have a clear profit on their contracts for every hundred maunds they supply. Charcoal could be taken down at much less cost by boats on the Béas, it could then be landed at Amritsar for from Rs. 60 to 70 per hundred maunds."

2109.—[5129]. Charcoal from the "khair" (*Acacia catechu*).

2110.—[5130]. Charcoal from the "mango."

2111.—[5131]. Charcoal from the "Gurnah" (*sic*).

2112.—[5132]. Charcoal of the "thohr" (*Euphorbia antiquorum*).

2113.—[5133]. Charcoal of "kíkar" (*Acacia*). Hushyarpúr.

2114.—[5134]. Charcoal of "phúláhi" (*A. modesta*).

2115.—[5136]. Charcoal of "madár" (*Calotropis*). Hushyarpúr.

2116.—[5136]. Charcoal of "amaltâs" (*Cassia fistula*). Hushyarpúr.

2117.—[5137]. Charcoal of "dháwí" (*Grislea tomentosa*). Hushyarpúr.

2118.—[5171-76]. A series of charcoals. LOCAL COMMITTEE, Amritsar.

From the karír (*Capparis*).
" kíkar (*Acacia*).
" phúlahí (*A. modesta*).
" jhand (*Prosopis spicigera*).
" chhichra (dhák), (*Butea frondosa*).
" chíl (*Pinus longifolia*), (imported from the hills), *vide supra*.

2119.—[5187]. Is a sample of charcoal from Gujranwalla, burned from the "ak" or "madár."

END OF VOL. I.

ENGLISH AND SCIENTIFIC INDEX.

C.

D.

E.

G.

H.

I.

M.

N.

O.

S.

T.

U.

V.

W.

X.

VERNACULAR INDEX AND GLOSSARY.

☞ H. Hindí. | Pji. Punjabí. | A. Arabic. | S. Sanskrit.
Hi. Híndústání. | P. Persian. | Pshtu. Pashtú. | Th. Thibetán.

C.

	No.	Page.
Chíti, *see* Lhím tser (Kanawár, Chamba, &c.), (*Pinus excelsa*), lofty pine,	1995	588
Chítimírák (*Heliotropum brevifolium*),	1349	360
Chitpatra (Kaghán), (*Marlea begonifolia*),	585	1969
Chitra (*Berberis lycium, Asiatica* or *aristata*),	1119	330
Chitra (Murree and Hazára), (*Staphylea emodi*),	2070	597
Chitramúl (*Thalictrum foliolosum*),	1084	324
Chitra (*Plumbago Europea*),	1427	368
Chitta búti (Murree, &c.,) (*Buddleia crispa*),	1857	570
Chittal, the spotted deer (Simla States),	606	155
Chitta rohi, sand with salt efflorescence,		200
Chittiphúl (*Heliotropium brevifolium*),	1349	360
Choda (Hazára), (*Pyrus baccata*), crab apple,	2019	592
Choil (Punjabí, Cis-Sutlej), low swampy undrained land,		141
Chola (*Cicer arietinum*),	1216	342
Punjabi gram (*Cicer arietinum*),		240-1
Chok (*Gmelina arborea*),	1392	365
or choka (*Rumex vesicatoria*),	1441	372
Chora (Kaghán), (*Quercus dilatata*),	2025	592
ditto (*Quercus ilex*),	2026	593
Chora (Simla hills), (*Angelica archangelica*),		320
Do.	1303	354
Chor, *see* Líchakhro (*Coriaria nepalenses*),	1889	575
Chitta búti (Murree), (*Abelia triflora*),	1809	564
Chótta (Kaghán), (*Pyrus kumaonensis*),	2081	592
Chúa (Kulú), an amaranth cultivated for its grain,	869	244
Chughar (Kuhát), of land moist and cool,		202
Chúhá, a rat,		156
Chuhára (*Phœnix dactylifera*),	1501	379
Chúhá (kán kachnhá), "the large eared rat" (Kaghán), the marmot or *Arctomys*,	627	156
Chú,í (*Armeniaca vulgaris*), apricot,	1835	567
Chúi, the apple (Chamba) and hills elsewhere.		
—— (Pangi name), (*Pyrus malus*), apple tree,	2022	592
Chukri (*Rheum palmatum*),	1439	369
Choí, the outer leaf or spathe of the sugar-cane,		225

	No.	Page.
Chúla, a fire grate, made of mud or bricks,		82
Chamyárí (Murree hills), (*Cerasus puddum, Prunus puddum*), bird cherry,	1881	574
Chún (*Euphorbia Royleana*),	1923	589
Chúnah, lime,	246	40
Chún ká pattar, erroneously applied to *gypsum* (makol), in the Lower Hills.		
Chúna ka pathar, limestone for burning.		
Chúng or chúnt (Pangi and Chenáb), (*Pyrus malus*), apple tree,	2022	592
(*Salix alba*), white willow,	2057	596
Chunni safaid (*Abrus precatorius*), seeds,	1204	340
Chúr (Kishungunga), (*Quercus ilex*),	2026	593
Chúra, caste of sweepers, one of the ghair mulázim in a village (*see* Ghair mulázim),		211
Churál (*Lathyrus sativus*),	859	242
Churi saroch (*Artemisia scoparius*),	1328	358
Churwá, bruised rice,		232
Chutney, method of making,		273
Chú tsalé (Thibetán), coarse borax (from Ruthog)	413	94
Chúwá (Sirsa), 1st class barilla or sajji,		87

D.

	No.	Page.
Dab (*Poa cynosurioides*),	1840	383
Dáb (Delhi), (*Anatherium muricatum*), a grass,	1777	513
Dib (*Typha angustifolia*),	1504	379
Dib (*Eragrostis cynosuroides*), a grass,	1782	514
Dab (Kúhat), a moist soil, *see*		202
Dabbah, a grass, *see* Dab.		
Dadá, *see* Diar (Chamba, Chenáb and Rávi), (*Cedrus deodara*), deodar or Himálayan cedar,	1876	573
Daddá (Salt Range), (*Acacia eburnea*),	1815	565
Dadrú (Hazará and Murree), (*Rhamnus virgatus, persica*),	2033	594
Dag (Kúhat), land cultivated only once in three years,		202
Dáh (in the Hills), a flat beam of wood dragged over the fields to smooth clods; sohágá of the Plains,		213
Dahmahidar, farm servants hired for 10 months,		211

E.

F

H.

	No.	Page.
Khajúr (*Phœnix dactylifera*), -	1501	379
Khujiyáṅ, ditto, dates, -		*ib.*
Khajúrá, a concrete or tuffa of lime,	203	36
Khajúráṅ, a sweetmeat, -		309
Khajúr ka boklá ? kabal, *q. v.*		
Khajúr múnj, the fibre of the palm leaf, -	1797	517
Khaim or phaldu (*Nauclea parvifolia*), -	1983	586
Khair (*Acacia catechu*), catechu tree,	1814	565
Khájrú (Múltán), a kind of earth, -	141	24
Khák, dust earth.		
Khák-rob, (P.), "dust sweeper," the chura caste or sweepers; "ghair mulázim" in a village, *see* Ghair mulázim, -		211
Khákí, a quality of hemp resin or charras, -	1021	293
Khákhí dúdhyá (rang), gray, -		439
Khákshí (*Sisymbrium irio*), -	1099	327
Khál (Muzaffargarh), khillú, *q. v.*		
Khál, a skin or hide (Urdu), -	645	159
Khál (Pjí.), a skin or hide.		
——oil cake, the refuse of the mill after expression of the oil, -		419
Khálij, a kind of pheasant (*Gallophasis albocristatus*), (*note*), -		156
Khalátrí, the *Philipœa calotropidis*, *see Philipœa*, -	889	246
Khám (P.), raw. Revenue is said to be collected kham or land held kham, when done so direct by Government, and not through the medium of a farmer or other under-holder.		
Khám mitti (technical in Kurnál), or substance obtained in the process of making salamoniac, naushádar, -		90
Khambúr, the truffle, -	894	257-8
Khanṅ, a grass (*Panicum maximum*), Lahore, -	880	245
Khamir (P.), yeast, leaven, &c.		
Kharnúb (*Ceratonia siliqua*), -	1220	342
Khánchí, one of the men at a sugar press, -		305
Khand (*Saccharum officinarum*), -	1543	383
Khangar or kakkar (Salt Range, &c.), (*Pistacia integerrima*), -	1998	589
Khánsi, a bell metal, -	80	15
Khár, the soda plant (*Coronylon Griffithii*), -		88
Khára sajji, 2nd quality sajji (Sirsa), -		87
Kharaira (Pshtú.), the mushroom, -	893	257

	No.	Page.
Kharátí, wood turner, the colors used by him, -	349	64
Kharátín khushk, dried earth worms, a drug, -	594	153
Kharbúza (*Cucumis melo*), -	1266	347
the musk or sweet melon (*Cucurbita melon*), -	938	265
Khardal (*Brassica campestris*), -	1105	328
Khargosh (P.) a hare, -		156
Kharíf, called by the common people Sawáni, the autumn harvest sown when the first rain falls in early summer.		211
Kharíf, the autumn harvest ripens towards cold weather, and sown in summer,		iii.
Khár-i-khushk (P.), (*Tribulus lanuginosus* and *terrestris*,) -	1161	335
Kharí matti, white clay, chalk, -	151	26
Khán shor (Gurgaon), brackish water,		208
Kharkhusa (*Suedia fruticosa*), -	1446	372
Kharpalú cheraí (Pshtú.), (*Quercus ilex*), -	2026	593
Kharpat (*Garruga pinnata*), -	1941	581
Khár shutar (*Alhagi maurorum*), -	1202	340
Kharsú, *see* Kharsúi (Kanawár), (*Quercus semacarpifolia*), alpine oak, -	2028	593
Kharwá tel, coarse oil, rape oil, -	1618	418
Kharwé (Pshtú.), (*Cotoneaster bacillaris*), Indian mountain ash, -	1894	576
Kharya matti, or kharí matti, fire clay, white earth, -	151	26
Khas (*Cymbopogon aromaticus*), -	1534	383
—— the root of the *Anatherium muricatum*, used to make tatties, -	1803	518
——the "kuskus" root for tatties, &c.,	1803	518
——ká bíj (*Lactuca sativa*), -	1311	355
Khash khás (*Papaver somniferum*), seeds, -	1089	325
Khash-khás ka tel, ditto, poppy oil, -		*ib.*
Khash-khás, poppy seed, -	1024	295-6
Khash khásh, poppy seed, Khash-khásh ka tel, poppy seed oil, -	1626	421
Khasta, khista, *q. v.*		
Khatau (Pangi, &c.), (*Quercus semacarpifolia*), alpine oak, -	2028	593
Khatár, a sweetmeat, -		309
Khat karwa, morel, -	1557	384
Khatrán *see* Pindrau (Sutlej Valley and Bassahír), (*Picea Webbiana*, *Picea pindrow*), the silver fir,	1994	587-8
Khattá, the acid lime or citron (*Citrus medica*), -		267

M.

O.

R.

	No.	Page.
Rich, *see* Thálin (Kotgarh), (*Viburnum fœtens*), -		601
Rín or rínj (Hazara), (*Quercus incana*), heavy oak, -	2027	593
Rinch (Kashmír), a bear.		
Riudi dowa (Thibet), lead ore, -	52	11
Ringa (*Vitex trifolia*), -	1386	364
Ringyál (Kanawár), (*Rosa Webbiana*), -	2046	595
Rinsot (Kanawár), (*Eleagnus conferta*), -	1918	578
Ríthá (*Sapindus detergens* or *acuminatus*), -	1116	330
——the soap nut (*Sapindus emarginatus*), -	1704	453
Riyál, *see* Túng (*Picea Webbiana*, *Picea pindrow*), the silver fir,-		588
Rodang, madder, -	1667	442
Rohi (Pjí.), a kind of soil, stiff loam,-		140-99
Rohíra (*Tecoma undulata*), -	2083	599
Roíñ, a kind of bell-metal, -	80	15
= Rawán (Amritsar), *q. v.*		
Rol, alum shale. -		84
Rola, a red powder used at the Holí festival, -	1709	454
Ror (Pjí.), sometimes for kunkur, or broken brick for gravel, -		199
Roti, bread, chapattis or flat cakes. English bread is called "dabbal roti" (double loaf).		
Rrei (Chilás), (*Picea Webbiana*, *Picea pindrow*), the silver fir,-		588
Rúbabárík (*Solanum sp.*——, *incerta*),	1375	363
Rúí, cotton, -	1731	477
ditto, -	1134	332
ditto, -		iv.
Rukh (Hdí.), a tree (used in the "hill chiefs".		
see laínyá (Salt Range (*Tamarix gallica*, Syn. *Indica*), -	2080	598
(Salt Range), (*Tamarix orientalis*), tamarisk, -	2081	598
Rúkhan (*Sizygium jambolanum*), -	2075	598
Rukr (Jhilam district), bad soil, -		201
Rúlyá (*Rottleria tinctoria*), red powder of, -	1474	376
Rúmar or rúmal (Kangra), (*Ficus glomerata*), -	1929	580
Rumul (Kaghán), (*Ficus Roxburghii*, *Macrophylla*), -	1932	580
Rúñ (Pjí.) = Rúí, *q. v.*		
Runa, Bunan dialect (Thibet), madder,	1667	442
Rupamakhi, iron pyrites, *see* Son-Makhi, -	37	8

	No.	Page.
Rúpa, silver, but generally used to mean alloyed or impure silver.		15
Rust (Spiti) = lajward or lapis lazuli,	330	48

S.

	No.	Page.
Sa, salt (Thibetán), -	371	779
Sá'ad kofi (*Cyperus longus*, *rotundus*, &c.), -	1531	382
Sábún, soap, process of making, described, -	1661	426
Sábúni, a kind of emerald, -		49
Sabz (rang), green, -		439
Sabza, emerald, -		49
Sabzí, a variety of rice, -	311	233
Sabz mitti, an earth used to wash the hair, -	141	24
Sádá guláb (*Rosa sinensis*), -	1259	347
Sadbagh or sadbarg (*Senecio*), -	1314	355
Sadbargí (*Tagetes erecta*), -	1336	358
Safaid sembhal ka phúl (*Eriodendron anfructuosum*), -	1146	333
Safarjal (*Cydonia vulgaris*), quince, -	1262	347
Safeda, a quality of fair rice, -	823	234
Safeda (Kanáwar) (*Populus fastigiata*), -	2007	590
Safeda, ceruse, white lead, -	340	63
Safed moth, occasionally applied to *Cyamopsis psoraloides*, guar.		
patthar, a white alabaster (Shahpúr), -	221	37
Safed sona, platinum, -		14
Ság, green vegetables.		
Saggar, *see* Baddí kánder (Salt Range), (*Ehretia asperia*), -	1916	578
Sag-i-ábi, the otter (Bunnoo), -	623	155
Ságkarm or karamb (*Brassica oleracea*), -	1103	328
Saglahú, the otter (Bunnoo), -	623	155
Sagwán (*Tectona grandis*), teak, -	2084	599
Sahádevi (*Crozophora tinctoria*), -	1475	376
——bari (*Sonchus orixensis*), -	1313	355
——ditto (*Vernonia cinerea*), -	1322	357
Sahansabed (P.), (as a drug), hematite, -	496	101
Sahukár, a money lender, -		210
Sai (Chamba), (*Deutzia staminea*), -	1910	578
Saídi, a kind of emerald, -		49
Saín, the flying squirrel (Kangra), -	610	155
Sail, slate or schist, -		37-8
Sailábi, land watered by flood (Sailab) of the great rivers, or overflow of waters from other sources, -		140

T.

U.

V.